

# THE YOUNG ASTRONOMER

A large, ornate telescope is mounted on a tripod stand. A young person is kneeling next to the base of the stand, looking through the eyepiece. The telescope is pointed upwards towards the sky.

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# THE YOUNG ASTRONOMER;

OR,

HELPS TO A KNOWLEDGE OF THE LEADING  
CONSTELLATIONS.

\* \* \*

*"O were I but a king, the alarm-bell should sound every night, in order to compel my subjects of every age, sex, and condition to run to their windows and survey the firmament."*—COUNT DE MAISTRE.

\* \* \*

✓  
BY JAS. H. CARLISLE,  
President of Wofford College, South Carolina.

\* \* \*

SUNDAY-SCHOOL DEPARTMENT.

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## INTRODUCTION.

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“FOR many years it has been one of my constant regrets that no school-master of mine had a knowledge of natural history—so far, at least, as to have taught me the grasses that grow by the way-side, and the little winged and wingless neighbors that are continually meeting me with a salutation, which I cannot answer as things are. Why didn’t somebody teach me the constellations, too, which are always overhead, and which I don’t half know to this day? I love to prophesy that there will come a time when not in Edinburgh only, but in all Scottish and European towns and villages, the school-master will be required to possess these two capabilities (neither Greek nor Latin more strict), and that no ingenious little denizen of this universe be thenceforward debarred from his right of liberty in these two departments, and doomed to look on them as if across grated fences all his life.”

This passage is found in a letter from Thomas Carlyle to one engaged in educational pursuits. The patient, untiring Scotchman could rewrite a large pile of manuscript sheets that had been carelessly destroyed, but he could not learn the names of the constellations which were left out from his school lessons. Very few grown

people are willing to become children that they may begin the alphabet of any new study.

It is not possible for any text-book to give the names of the "grasses and winged or wingless insects," that pupils in different parts of our wide-spread country can see at a given hour. But this can be easily done in the case of the constellations.

At intervals, for more than twenty years, short articles like those composing this little volume have appeared in the *Southern Christian Advocate*, under the title of "The Young Astronomer." The name is retained, though it may perhaps be too pretentious. The book is not an "Astronomy" in any sense. It may be a help to *children*, indirectly, through their parents or teachers; and to *young people*, directly, in getting some knowledge of the leading constellations.

May it lead some readers to "make friendships with the stars," and to "seek Him who maketh the Seven Stars and Orion!"

J. H. C.

Spartanburg, S. C.



## SUGGESTIONS TO READERS.

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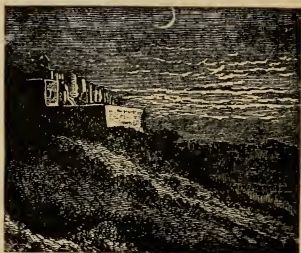
THE first chapter may be read at any time, as it refers to stars that may be seen every evening in the year.

The remaining chapters refer to stars that rise and set. Under any given date there will be found some constellations visible at 8 o'clock on that evening. Several neighboring dates may be consulted also. On the first evening of any month, at a given hour, the stars occupy the positions which they held two hours later on the first of the preceding month; and they will hold the same relative positions two hours earlier in the following month, at the same day. For example: On the first evening in December, at 8 o'clock, the stars will appear as they did at 10 o'clock November 1, and as they will appear at 6 o'clock on January 1.

Eight o'clock is rather late for a winter evening; but it is best to have a uniform hour through the year, and no earlier hour could be taken for summer.

This time—8 o'clock P.M.—in every case means the true local time; not the railroad time, now so generally used. The difference in many places will not be material.

There are three dates given in each month—1st, 10th, and 20th. For evenings between these the *nearest* date, either before or after, may be used.



# CONTENTS.

\* \* \*

	PAGE
CHAPTER I. STARS THAT NEVER SET.....	11
CHAPTER II. STARS THAT RISE AND SET.....	31
January 1, 8 P.M., or February 1, 6 P.M.....	31
January 10, 8 P.M.....	35
January 20, 8 P.M.....	37
February 1, 8 P.M., or January 1, 10 P.M.....	41
February 10, 8 P.M.....	44
February 20, 8 P.M.....	47
March 1, 8 P.M., or February 1, 10 P.M.....	49
March 10, 8 P.M.....	51
March 20, 8 P.M.....	52
CHAPTER III. STARS THAT RISE AND SET.....	55
April 1, 8 P.M.....	55
April 10, 8 P.M.....	56
April 20, 8 P.M.....	57
May 1, 8 P.M.....	61
May 10, 8 P.M.....	64
May 20, 8 P.M.....	67
June 1, 8 P.M.....	68
June 10, 8 P.M.....	70
June 20, 8 P.M.....	72
CHAPTER IV. STARS THAT RISE AND SET.....	76
July 1, 8 P.M.....	76
July 10, 8 P.M.....	78
July 20, 8 P.M.....	80
August 1, 8 P.M.....	82
August 10, 8 P.M.....	84
August 20, 8 P.M.....	86

September 1, 8 P.M.....	93
September 10, 8 P.M.....	95
September 20, 8 P.M.....	97
CHAPTER V. STARS THAT RISE AND SET.....	100
October 1, 8 P.M.....	100
October 10, 8 P.M.....	101
October 20, 8 P.M.....	102
November 1, 8 P.M.....	104
November 10, 8 P.M., or December 1, 6 P.M....	107
November 20, 8 P.M.....	115
December 1, 8 P.M., or January 1, 6 P.M.....	117
December 10, 8 P.M.....	120
December 20, 8 P.M.....	121
CHAPTER VI. SUN, MOON, AND PLANETS.....	127
The Sun.....	127
The Moon.....	129
Planets.....	133
Mercury.....	134
Venus.....	135
Mars.....	137
Jupiter.....	138
Saturn.....	139





# THE YOUNG ASTRONOMER.

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## CHAPTER I.

### STARS THAT NEVER SET.

#### I.

THERE are some stars that never sink below our horizon. They may be seen at any clear hour of any night in the year. The number of these stars varies with the place where the observer lives. The farther north the greater is the number of these never-setting stars. Some stars that never sink below the horizon at Boston do set to the people of Charleston. There is a very remarkable group of stars which, in whole or in part, are always visible all over the United States. Their shape is like this:

      \*      \*      \*  
                  \*                  \*  
                          \*                  \*  
                                  \*                  \*

These seven stars are rather bright,

though not belonging to stars of the first class in brightness. They have been famous in the history of all nations whose literature has come down to us. Different names have been given to them. The most common one is the Bear. These seven stars alone were not likened to a bear, but other stars lying around them for a considerable space were joined with them. Greeks and Romans called them by this name. It is said that some tribes of our Indians called them by a word meaning "bear" in their languages. Let the first lesson of the young astronomer be to learn these seven stars.

There is another common name, the Dipper, which may be familiar to some; four stars making the dipper, and three the crooked handle. If you could watch this group for twenty-four hours, and if you could see them by daylight, you would notice that the handle of the Dipper pointed in all directions: at one time to your right;

then up toward a point above your head; then to your left; and again down toward the horizon. In a large portion of the United States the handle is cut off by the horizon for a part of every twenty-four hours. These stars seem to turn round some point in the sky every twenty-four hours. Take the two stars forming the outer end of the Dipper. They point toward this spot. Start from the star at the bottom of the Dipper at its outer end; go to the star at the top; now go on in the same direction about six times as far as the distance between these two stars, and you will be very near a star more remarkable than any one of the seven in the Dipper. This is the North Star. It is not so bright as any one of the Dipper stars, but its position makes it in some respects the most remarkable star in the sky; and it is strange that this star is one of a group of smaller stars, arranged in a smaller Dipper. It is at the end of the long, crooked handle of the

small Dipper. The relative positions of the two Dippers are something like this:



About the 1st of November the large Dipper is low down on the horizon, at 8 P.M., with its handle pointing to the left, as we face the north. Three months later (February 1), at the same hour, it is high up in the north-east, with the handle pointing downward. Three months later (May 1) it is overhead, the handle pointing to our right. On the evening of August 1, at 8 o'clock, it is in the north-west, the handle pointing upward. Three months still later,

at 8 o'clock P.M., it will be as it was one year before at the same day and hour.

Again, let us begin at 8 P.M., November 1. In six hours (2 A.M., November 2) the ladle will have made one-quarter of a revolution, and will be in the north-east, with the handle downward, as at 8 P.M., February 1. Six hours later (8 A.M.) it will be overhead, as at 8 P.M., May 1. Six hours later (2 P.M.) it is in the north-west, as at 8 P.M., August 1. And six hours later will bring us to 8 P.M., where we started. Strictly speaking, the ladle will be in the same position four minutes earlier each evening—that is, at four minutes before 8 P.M., November 2, it will be exactly as it was at 8 P.M. on November 1. And so it is with all the stars, because of their rising four minutes earlier each evening.

The constellation of which the Great Dipper is a part is frequently called by its Latin name, *Ursa Major*, the Great Bear.

Put a pin through the leaf at the North Star, and turn the leaf around, so that the upper part will go from right to left while the under part of the leaf goes from left to right. This will show you how the stars in the never-setting circle move around the North Star. Strictly speaking, they move around the North Pole, but this is so near the North Star that the difference is of no consequence at this stage in your star studies.

The Astronomer Royal of England once said that there were many people in that country who did not know that the stars rise in the east and set in the west, just as the sun does. There may be persons of some intelligence who have never found this out for themselves. Let them notice the stars that are low down in the east soon after dark. Before bed-time take another look. Those stars are higher up. In the west those stars which you could see early in the evening near the horizon are not seen

at bed-time, for they have sunk below the horizon.

The North Pole is very near the North Star, and its height above the horizon is always just equal to the latitude of the observer. Those who live in the thirtieth line of latitude have the North Pole exactly thirty degrees above the horizon—that is, just one-third of the way from the horizon to the point overhead. The North Star is near the Pole, so that the height of that star is nearly equal to the latitude of the place. A person living in Florida will see the North Star not quite one-third of the way up to the zenith. To those living in the middle belt of our country it will be more than one-third, while those living in Northern Maine see the North Star nearly half-way up between the horizon and the point overhead.

The two Dippers should be well learned, so that on any clear evening the young observer can readily find the North Star. First find the Great Dipper. Its two

“pointers” will show you the line pointing to the North Star. Fortunately this star, though not very bright, has no brighter star anywhere near it; so that it is easily found. You will always find the two Dippers pointing in opposite directions. If the handle of the Big Dipper points to your right, the Little Dipper is turning its handle toward the left.

The North Star is at the end of the handle of the Little Dipper, or at the end of the tale of the Little Bear. “Arctic” is from a Greek word meaning “bear.” The Arctic Ocean is the one lying under the Northern Bears. The North Star is sometimes called by another Greek word—*Cynosure*—which means “tail of the dog.” The long curved handle of the Little Dipper was supposed to be like the tail of a dog. The North Star is often called *Polaris*. The constellation in which it is found is sometimes called by its Latin name, *Ursa Minor*, the Smaller Bear.



## TO THE NORTH STAR.

The sad and solemn night  
Has yet her multitude of cheerful fires:  
The glorious host of light  
Walk the dark hemisphere till she retires.  
All through her silent watches, gliding slow,  
Her constellations come, and climb the heavens, and go  
And thou dost see them rise,  
Star of the pole! and thou dost see them set.  
Alone, in thy cold skies,  
Thou keep'st thy old, unmoving station yet;  
Nor join'st the dances of that glittering train,  
Nor dipp'st thy virgin orb in the blue western main.  
And therefore bards of old,  
Sages and hermits of the solemn wood,  
Did in thy beams behold  
A beauteous type of that unchanging good,  
That bright, eternal beacon, by whose ray  
The voyager of life should shape his heedful way.  
—*Bryant.*

---

## II.

The Little Dipper can be seen in all its parts from every spot in the United States, on any clear evening and at every hour in

the evening. This singular little group is in the center of our never-setting stars.

The whole of the Great Dipper can be seen from the northern part of our country, through the whole night, at every season of the year. In Pennsylvania, Ohio, Indiana, and other States on the same line, and in all States north of that line, the handle of the Great Dipper, when lowest, is not cut off by the horizon. But in all States south of these some part is hidden by the horizon during a part of every twenty-four hours. The farther south we go the larger the portion of the handle that is hidden. When we reach the extreme southern point of Florida, not only the handle, but the whole of the Dipper is hidden for a short time. But in the greater portion of our Southern States enough of the Great Dipper can be seen, at any clear hour of the night, for the young "star-gazer" to find the North Star by its help.

That point on the horizon just below the

North *Pole* is exactly the north point; but for our purpose we may consider the point of our horizon below the North *Star* to be north. When the north point of the horizon is found, the other points—east, west, and south—are known at once.

The learner who knows the two Dippers (or Bears) well has made a good beginning. Clear knowledge grows rapidly and easily.

TO THE GREAT BEAR (URSA MAJOR).

With what a stately and majestic step  
That glorious constellation of the north  
Treads its eternal 'circle! going forth  
Its princely way, among the stars, in slow  
And silent brightness. Mighty one, all hail!  
I joy to see thee on thy glowing path  
Walk, like some stout and girded giant: stern,  
Unwearied, resolute, whose toiling foot  
Disdains to loiter on its destined way.  
The other tribes forsake their midnight track,  
And rest their weary orbs beneath the wave;  
But thou dost never close thy burning eye,  
Nor stay thy steadfast step.

—Henry Ware, *Jr.*

## III.

There are other constellations in the circle of never-setting stars. The most striking one is Cassiopeia, the finest portion of which is always visible in the middle and upper parts of our country. Start from the star where the handle of the Great Dipper joins the bowl, and go to the North Star. Now continue this line about as far beyond, and you will reach Cassiopeia's Chair, as the constellation is usually called. There are four stars forming a dipper, and others for the broken handle. These four stars are supposed to form the body of a chair, while the others are the back. One of the four stars (the one nearest the North Star) is quite faint, being not above the third magnitude. Leaving this out of the figure, the others form a large W, with the sides pulled out wider than usual, and the open parts of the letter toward the North Star. This constellation is not hard to find, as it is always as far from the North Star as the

Great Dipper is, but on the opposite side. Facing the north, if the Dipper is to your right, Cassiopeia is to your left. When the Dipper is on the horizon, Cassiopeia is up on the meridian, *above* the North Star, the Dipper being on the meridian *below* it.

When the Great Dipper is in the northeast (as it is about 8 o'clock P.M. in the middle of February), with its handle pointing downward toward the horizon, the Camelopard (Giraffe) is on our meridian, above the North Star. West of that constellation is Cepheus, and then a part of the Dragon. Notice that these constellations (all lying partly within our never-setting circle) come in alphabetical order: Bear, Camelopard, Cassiopeia, Cepheus, Dragon. There is no star of the first magnitude within *our* circle of never-setting stars, except to those in the northern part of Maine, where two first-class stars, Arided and Capella, are always visible. There are not many second-class stars within this circle. It is easier to learn the

few brighter stars that are to be seen at all times. The stars in the Great Dipper are all second-class stars, except the one where the handle joins the Dipper. It is only of the third magnitude.

The North Star is of the second magnitude. All other stars in the Little Dipper are smaller, except the two on the end of the Dipper farthest from the North Star. These two are known as the “guards of the pole.” They are nearly one-third of the way from the North Star to the last star in the handle of the Great Dipper, and the line joining these two “guards of the pole” is about parallel to the line of the middle joint of that handle.

These Bears should be learned well. At any hour of any night they can be seen. The other constellations near them (Camelopard, Cepheus, and Dragon) are not worthy of much attention now. You may easily learn more about them hereafter.

The phrase, “stars of the first magni-

tude," has no reference to the size of stars, but only to their brightness to our eyes. All stars seen by the naked eye are roughly divided into six classes. The sixth class is made up of the faintest stars which our unaided eyes can see. The fifth class is composed of those a little brighter; and so on, up to the very brightest, which compose the first class, or stars of the first magnitude.

As there is around our North Pole a circle of never-setting stars, so around the South Pole there is an equal circle of never-rising stars—that is, there are stars near the South Pole which *we* can never see, unless we travel southward. In that circle there are stars of the first magnitude. Those persons living in Brazil never see the Great Bear, but they see some fine constellations which we do not see.

At any one time scarcely three thousand stars of all sizes are visible to the naked eye. The common estimate of the number

is very erroneous. Telescopes widen the range of vision, so that the number of stars is counted only by millions. The famous Lick telescope (California) has its glass three feet in diameter. An immense eye like that, turned intelligently to the sky, must see many hidden wonders and glories.

But the reader must not be discouraged because he has no fine telescope in reach. A good eye can see many wonderful things in the skies. It has been said by those able to judge wisely that “the use of a telescope lessens the beauty of the appearances seen without one. Telescopes are useful means of acquiring knowledge, when used by persons who understand how to use them to good advantage; but they add little or nothing to the grandeur and beauty of the sky and stars.” (Arthur Searle.)

The ancients numbered nearly fifty constellations of all sizes. Modern astronomers have about doubled the number by picking up scattered stars not included in the lead-



ing constellations. Many of these are not worth the attention of beginners. Only those of some importance will be noticed in these pages.

In addition to names given to groups of stars, individual names have been given to about one hundred stars, embracing all of the first magnitude, many of the second, and a few of the third. It will be sufficient to our purpose if the reader will become familiar with the names of those in the first class.

The number of stars of the first magnitude is not positively fixed, as there is no sharp dividing line between the grades. Some astronomers rank only a dozen stars in the first class, while others increase the number to twenty. Several of these first-class stars are hidden from us in this latitude.

Here is a list of the stars of the first magnitude which can be seen by the inhabitants of the United States. The relative

brightness is difficult to estimate exactly, but our list is arranged in the order of brightness as some good authorities place them:

Sirius, in Canis Major. See date, February 10.

Canopus, in Argo Navis, February 10.

Arcturus, in Bootes, May 10.

Rigel, in Orion, January 20.

Capella, in Auriga, February 1.

Vega, in Syra, August 20.

Procyon, in Canis Minor, March 1.

Betelgeuse, in Orion, January 20.

Achernar, in Eridanus, December 1.

Aldebaran, in Taurus, January 1.

Antares, in Scorpio, July 20.

Altair, in Aquila, September 20.

Spica, in Virgo, April 20.

Fomalhaut, in Southern Fish, October 20.

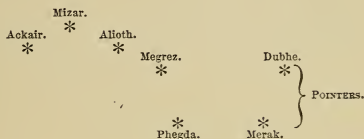
Pollux, in Gemini, February 20.

Regulus, in Leo, March 20.

The number of stars in each class increases rapidly as we go to lower classes.

The number of stars of the *second* magnitude is perhaps four times as great as in the first; while the third class has perhaps three or four times as many as the second, and so on.

As the Great Dipper is so conspicuous, it may be well to give the names of its seven remarkable stars, though only of the second magnitude, except Megrez, which is of the third:



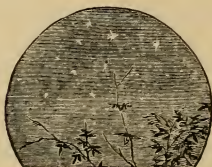
Dubhe and Merak are the pointers. Their line of direction (from Merak to Dubhe), continued, always passes near the North Star.

Look closely, on any clear night, at the star Mizar, at the break in the handle of the Dipper. You can see a faint star very near it. The Arabians call it Alcor, “the

test," perhaps meaning that it required a good eye to see it. An ordinary eye can see it now, which leads some astronomers to suppose that Alcor is gradually becoming brighter.

For one star differeth from another star  
In glory and in use; and all are stars  
Of the illimitable house of God;  
And every one has its own name and place  
Distinguished; and some special word is given  
For each to utter in the mystic song  
Which is not found in speech of humankind,  
Which is not understood by human heart.

—*Mrs. Hamilton King.*



## CHAPTER II.

### STARS THAT RISE AND SET.

\* \* \*

JANUARY 1, 8 P.M.,  
OR FEBRUARY 1, 6 P.M.

THE meridian is a line beginning at the northern point of our horizon, passing up through the North Pole (very near the North Star), and through the point in the sky immediately overhead, and reaching to the southern point of the horizon. It thus divides all the visible sky into two equal parts. Our zenith is the point in the meridian exactly overhead.

Let us go out under the clear sky at this hour—January 1, 8 P.M. A few degrees south-east of our zenith are the Seven Stars:

The group of sister-stars, which mothers love  
To show their wondering babes—the gentle seven.

—*Bryant.*

This well-known cluster will do very well  
(31)

to begin with. Though called the Seven Stars, most eyes see but six, the seventh being not quite bright enough for a common eye to discover. There are no very bright stars in the group, the brightest one being only of the third magnitude, the others of the fourth and fifth. Very few stars as faint as these have individual names; but the brightest is called Alcyone, and the others have names borrowed from Grecian fables. The Greek name for the group is Pleiades, from a word meaning "to sail," as the sailors regulated their voyages by the rising or setting of these stars. A few unusually good eyes see eight or nine stars in the Pleiades. There are several stars in the group which are *not quite visible* to common eyes. A small spy-glass will show other stars in this group, while in telescopes they are counted by scores or even hundreds.

It is necessary to know something about measuring the distance between stars, as they appear to us. This cannot be done by

inches, feet, or miles. It can only be done by *degrees*. The two “pointer stars” in the end of the Great Dipper are about five degrees apart. The two in the bottom of the Dipper are twice as far apart, or ten degrees. These instances will help you to measure other distances. Now start from the Seven Stars, and go toward the south-east fifteen degrees, and you will reach a bright, reddish star of the first magnitude—Aldebaran. It is at the end of one of two rows of stars which together make the letter V, the sharp point being turned toward the south-west. The stars in this singular group are called Hyades, from a word meaning “rain,” as the Greeks supposed storms to attend certain risings of this constellation.

Several centuries before the Christian era the stars were divided into fanciful groups, bearing names of animals or men and women, and in some instances of the gods of the ancients. This division is of very little use to astronomers, but it is still

used for common purposes. In geography when we call Italy “a boot,” and tell a pupil that Otranto is in the heel, he knows at once where to look. In some such way these fanciful constellations may be used. Aldebaran is in the eye of the Bull, and the Seven Stars are in his neck. The Bull has no body. The ancients only gave him shoulders, fore-legs, and head. The Pleiades are in his neck, the Hyades in his face, with Aldebaran for his eye. Many of the stars bear Arabic names. Aldebaran is said to be an Arabic word, meaning “the hindmost one.” This bright star seems to drive the Seven Stars before it, as they all pass from east to west across the sky.

The Pleiades rise before bed-time about the first of October. They rise (*as all the stars do*) four minutes earlier each evening, so that by the latter part of November they rise about sunset. They can be seen at early hours until May, when they are too close to the sun to be seen. All through



fall, winter, and spring this beautiful group can be seen at convenient hours.

The boundary lines of constellations are not as clearly defined as those of States on our maps; still it may be useful to give the neighboring constellations. Taurus is bounded on the north by Auriga and Perseus, on the east by the Milky Way and Orion, on the south by the whale, and on the west by Aries.

Canst thou bind the sweet influences of Pleiades,  
Or loose the bands of Orion? — *Job xxxviii. 31.*

---

### JANUARY 10, 8 P.M.

Immediately or very nearly overhead is a cluster of stars called the head of Medusa. Starting from this point, and going toward the North Star, for fifteen or twenty degrees we are passing through Perseus, who carried Medusa's head in his hand. The finest part of Perseus lies a little to the left of our meridian as we face the north. Between his body and Cassiopeia (farther to

our left) is a bright patch like a spot of the Milky Way. This is a famous nebula in the sword-handle of Perseus. A line from the last star in the handle of the Great Dipper, carried through the North Star and prolonged as far beyond, will lead to this nebula. You cannot well trace this line at this hour, as the handle of the Dipper is now cut off by the horizon to parts of our country; but you may remember this and trace the line at another time. Try to learn the chief points in Perseus. There are no stars of the first magnitude in Perseus, and only one of the second and four of the third; but lying in or near the Milky Way there is a "brilliant festoon of stars" which it will pay you to look up.

The brightest star in Medusa's head is a very remarkable star. At regular intervals (not quite three days in length) it rapidly changes from the second magnitude to the fourth, and back again. The Arabs called it Algol, the *ghoul* or *ghost*.

Perseus is bounded on the north by Cassiopeia and the Giraffe, east by Auriga, south by Taurus, and west by Andromeda. Perseus rises (far round to the north-east) at sunset, about the 1st of October, and is seen at convenient hours until May.

Look how the floor of heaven  
Is thick inlaid with patines of bright gold:  
There's not the smallest orb which thou behold'st  
But in his motion like an angel sings,  
Still quiring to the young-eyed cherubims;  
Such harmony is in immortal souls;  
But whilst this muddy vesture of decay  
Doth grossly close us in, we cannot hear it.

—*Shakespeare.*

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JANUARY 20, 8 P.M.

Our meridian at this hour passes through Taurus, with the Seven Stars on our right and Aldebaran in the Hyades on our left. A little to the south-east is Orion, the most striking constellation, in some respects, that we ever see. If you once trace clearly his strong outlines, you will not forget them. Let us try to do this to-night.

Go from the Seven Stars to Aldebaran (about fifteen degrees), and then continue the straight line about fifteen degrees farther. This brings you to a bright star which is the western shoulder of Orion. Eight degrees to the east is a still brighter star, in his eastern shoulder. About eight degrees south of these are three stars not so bright, in a straight line, about three degrees in length; these form Orion's belt. Eight degrees still farther south are two bright stars about eight degrees apart; these are Orion's feet. Now get the four bright stars, as in the corners of a rectangle, and the three in the middle well fixed in your outline. A few degrees above the shoulders are three very small stars, for his head. Below his belt are several small stars, to form his sword hanging from the belt. The great hunter, Orion, is holding up his large shield of lion's skin to defend himself from the Bull, which is rushing on him. This shield is traced by a half-circle of small

stars bent toward Aldebaran. With a little patience, good eye-sight, and a vivid imagination you can see a magnificent picture of a giant hunter. In the other hand he holds a club, which reaches up in the Milky Way.

The heavenly equator (which is the earthly equator prolonged to the sky) passes through Orion's belt. His shoulders can be seen to the North Pole of the earth, and his feet to the South Pole. Some portion of this splendid constellation can be seen from every spot on our earth's surface. By the arrangement and brightness of his stars Orion has been famous in all ages. The oldest writers, sacred and secular, speak of him in prose and poetry. He is mentioned in the book of Job and by Homer.

His eastern shoulder and western foot are stars of the first magnitude. Betelgeuse, the shoulder star, is reddish; while Rigel, the foot star, has a bluish tinge. When Orion is near the horizon (where stars twinkle most), you will be struck with the

beautiful play of colors if you will run your eyes rapidly from one of these stars to the other. The other shoulder and foot stars are of the second magnitude, as are also the three belt stars. Orion is one of the chief ornaments of our winter skies. He can be seen at early hours, from the middle of October to the first of May.

There are more than seventy stars of all sizes visible to the naked eye in Orion. The telescope of course multiplies his wonders and glories. On a clear, moonless night look very steadily at the middle little star in the sword. It seems to have a haze around it. To that hazy spot the largest telescopes in the world are often turned with anxious longings to explore its hidden wonders. Immediately under Orion's feet there are a few small stars, forming the little constellation Lepus, the Hare. Being a great hunter, Orion is followed by his Dog, with the flashing Sirius in his mouth, as we may see more particularly hereafter.

Orion is bounded by the Milky Way and Auriga on the north, by the Unicorn and Milky Way on the east, by the Great Dog and Hare on the south, and by Taurus and the Whale on the west.

The Arabs call Orion "Algebar," the Giant:

Sirius was rising in the east,  
And slow ascending, one by one,  
The kindling constellations shine.  
Begirt with many a blazing star,  
Shone the great giant, Algebar—  
Orion, hunter of the beast!

His sword hung gleaming by his side,  
And on his arm the lion's hide  
Scattered across the midnight air  
The golden radiance of its hair.

—*Longfellow.*

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FEBRUARY 1, 8 P.M.,

OR JANUARY 1, 10 P.M.

At this hour Auriga is on our meridian and in our zenith, his feet being above Florida and his head above the great lakes. A very bright star is in his breast. It can be

easily found, as it is the brightest near our zenith at this hour. This star of the first magnitude is called Capella, "a kid," as Auriga is represented on maps and globes as carrying a kid in his arms. About eight degrees east of this star is one not quite so bright, in the other shoulder. Nearly twenty degrees south of these are two stars (about eight degrees apart) for the feet of Auriga. With these four stars as an outline, you can form a very good plan of Auriga.

Capella is supposed by some to be the brightest star north of the celestial equator, though there are some others to dispute this claim. To some this bright star seems to have a bluish tinge. In the extreme northern part of Maine this brilliant star can be seen at every clear hour through every night in the year, it being within the circle of never-setting stars to those living in that latitude. In the middle and lower portions of our country it can be seen at convenient hours from the middle of September to June.



On our meridian, nearly twenty degrees above the southern horizon, there is a star of second magnitude, with smaller stars around it, forming the constellation Columba, the Dove.

Auriga, the Charioteer, is bounded on the north by the Giraffe (Camelopard), east by Gemini and the Lynx, south by Taurus and Orion, west by Perseus and the Milky Way. This constellation rises about sunset (east of north) early in November, and sets soon after sunset, about the middle of June.

Capella passes immediately overhead to the inhabitants of Maine. When Capella is sinking in the north-west, Antares is rising in the south-east.

Praise ye the Lord ;  
For it is good to sing praises unto our God.

. . . . .  
He telleth the number of the stars ;  
He calleth them all by their names.  
Great is our Lord, and of great power :  
His understanding is infinite.

—*Psalmist.*

FEBRUARY 10, 8 P.M.

Near our meridian, about one-third of the way from the southern horizon to our zenith, is the very brightest star in all the sky. This is Sirius, the Dog Star, so called because it is in the mouth of the Great Dog which is represented on maps and globes as sitting up, the bright stars for several degrees below Sirius forming his body. This brilliant star has sometimes been seen by keen eyes when the sun was shining brightly. No other star can compare with it in brightness. Different writers make different lists of first-class stars, varying in number and in the order of relative brightness, but Sirius heads every list. At one time, centuries ago, this star was red; for a long time it was white, and more recently it seems to some that it has a greenish tinge. Watch it closely, some clear evening, when it is near the horizon, and determine for yourself. When this star rose about sunrise, the ancients thought the extremely hot

days of midsummer were due to the combined heat of the sun and Sirius. They therefore called these the Dog Days. Then arose strange stories about dogs going mad at this season. But all this is now only a curious piece of history scarcely worth repeating.

Orion's belt is about half-way between Sirius and Aldebaran, and the three stars point nearly toward these two. This belt is about three degrees in length. For this reason it and the sword are sometimes called the "Ell and Yard."

When Sirius is on the meridian, another very bright star of the first magnitude may be seen by those living in the Southern States. This is Canopus, the brightest star in Argo Navis, a very large constellation, the greater part of which is always below our horizon. In Florida and the Gulf States it can be seen, as it rises a little way above the southern point of the horizon. Look for it when Sirius is on the meridian.

The large Dog (Canis Major) is bounded on the north by the Unicorn (Monoceros), east by the Unicorn and Argo Navis, south by Argo Navis, and west by the Hare.

This constellation rises in the south-east, at sunset, about the middle of February, and sets with the sun in the latter part of June.

The matchless Sirius never rises high in our latitude, scarcely reaching up one-third of the distance from the southern horizon to our zenith; but it is a conspicuous object in our evening sky for several months beginning with the year.

Hail, mighty Sirius, monarch of the suns!  
May we in this poor planet speak with thee?  
Say, art thou nearer to his throne whose nod  
Doth govern all things? Hast thou heard  
One whisper through the open gate of heaven  
When the pale stars shall fall, and yon blue vault  
Be as a shriveled scroll? —*Mrs. Sigourney.*

Notice that Sirius rises in the south-east about the time when Vega is setting in the north-west.

FEBRUARY 20, 8 P.M.

Almost immediately overhead is the constellation Gemini, the Twins. There are only a few bright stars in Gemini, yet on the whole it is a striking constellation, as some neighboring groups are rather blank. The heads of the Twins are marked by two bright stars about five degrees apart, the line joining them pointing north-west and south-east. They are about midway between Orion and the Great Dipper. The more northern one of these two stars is Castor; the other, Pollux. This latter star is low down in the list of first-class stars. Castor is of the second magnitude. The feet of the Twins are marked by faint stars, in a line (nearly parallel to the line of Castor and Pollux) lying on the eastern edge of the Milky Way.

Gemini is bounded on the north by the Lynx, east by Cancer, south by the Milky Way and Unicorn, west by Auriga. It is the most northern constellation in the eclip-

tic. It rises in the east in January, at sunset; and sets soon after sunset in the longest days of June. Through winter, spring, and early summer months this striking constellation can be seen. Castor passes over the zenith of places in the latitude of Charleston, and Pollux to those living in Middle Florida.

Paul sailed from "the island called Melita," in a ship "whose sign was Castor and Pollux." "The figures of the twin brethren were doubtless painted in the customary form, with stars above their heads, on each side of the bow of the ship. The thought, too, of an Egyptian ship, with heathen symbols, bearing the gospel to Italy is suggestive of many interesting reflections." (Dean Howson.)

The Lynx is a secondary constellation, covering a good space, but with no stars of even the third grade. It lies above Gemini, and partly between the Great Bear and Giraffe. A line from the heads of the Twins

to the North Star passes through the body of the Lynx, his head lying to the west.

Go, wing thy flight from star to star;  
From world to luminous world, as far  
As the universe spreads its flaming wall;  
Take all the pleasures of all the spheres,  
And multiply each through endless years  
One moment of heaven is worth them all.

—*Tom Moore.*

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MARCH 1, 8 P.M.,

OR FEBRUARY 1, 10 P.M.

Start from the zenith, and go down the meridian toward the south. About twenty-five degrees below Castor and Pollux the meridian passes very near a bright star of the first magnitude—Procyon, in the constellation the Little Dog. Procyon means “before the Dog.” In higher latitudes Procyon rises in the east before Sirius, in the Large Dog. With us the two bright stars rise about the same time. The Little Dog is a very small constellation. He is standing on the back of the Unicorn, Mon-

oceros. Our meridian now cuts the Unicorn through the middle, his head extending westward to the Milky Way, touching Orion, and his body about as far eastward.

Procyon, Sirius (now farther down to the right of the meridian), and Betelgeuse (in Orion's eastern shoulder) form a large, equal-sided triangle of five stars. Each side of this triangle is about twenty-five degrees in length.

At this season of the year, when the moon is not shining, look in the west after sunset for the zodiacal light. This is a singular cone of faint light, with its wide base resting on the horizon, and its top reaching up toward the zenith. It can be seen only at this season of the year, in the evening. The axis or central line of the cone lies along the zodiac.

In September and October the zodiacal light may be seen in the east, before sunrise.



O how canst thou renounce the boundless store  
Of charms which nature to her votary yields:  
The warbling woodland, the resounding shore,  
The pomp of groves, and garniture of fields;  
And all that echoes to the song of even,  
All that the mountain's sheltering bosom shields,  
And all the dread magnificence of heaven—  
O how canst thou renounce, and hope to be forgiven?  
—*Beattie.*

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## MARCH 10, 8 P.M.

Castor and Pollux, the two bright stars in the heads of the Twins, are near our zenith. A line from the northern star, Castor, through Pollux, and continued four degrees, will enter the western edge of the constellation Cancer, or Crab. This is a zodiac constellation, through which the moon passes every month. It has no bright stars. There is a remarkable cluster of small stars, which may be seen on a clear night, when the moon is not shining. Perhaps you can find it in this way: Begin at Sirius, now low down west of the meridian, and go to Procyon, nearly on our meridian, and go on

as far beyond Procyon. You will reach the cluster in Cancer called the Bee Hive. Gemini and Cancer lie farther north than any other zodiac constellations.

When I consider thy heavens, the work of thy fingers,  
The moon and the stars, which thou hast ordained;  
What is man, that thou art mindful of him?  
And the son of man, that thou visitest him?

—*David.*

Epitaph on the tomb of Daniel Webster,  
written by himself:

Lord, I believe; help thou my unbelief. Philosophical arguments, especially that drawn from the vastness of the universe in comparison with the apparent insignificance of this globe, have sometimes shaken my reason for the faith which is in me; but my heart has always assured and re-assured me that the gospel of Jesus Christ must be a divine reality. The Sermon on the Mount cannot be a merely human production. This belief enters into the very depths of my conscience. The history of man proves it.

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MARCH 20, 8 P.M.

Cancer is nearly in our zenith. To the east lies the Lion. About thirty degrees

south-east of our zenith is a star of the first magnitude. This is Regulus, in the breast of the Lion. About twenty-five degrees east of Regulus is another star, not quite so bright—Deneb, in the Lion's tail. This is a large constellation, containing nearly one hundred stars visible to the naked eye. Beginning at Regulus (the Lion's heart), and going toward the north-east about five degrees, you find a fainter star, from which a singular curve of small stars may be traced around toward the north-east, forming the Reap Hook, in the Lion's breast and neck.

The Lion rises at sunset about the middle of March; and sets soon after sunset, in the latter part of July.

North of the Lion there are a few faint stars, forming the smaller Lion. Below the larger Lion there are several small constellations in a barren part of the sky. The Virgin is east of Leo, and Cancer west.

O who can lift above a careless look,  
While such bright scenes as these his thoughts en-  
gage;  
And doubt, while reading from so fair a book,  
That God's own finger traced the glowing page;  
Or deem the radiance of yon blue expanse,  
With all its starry hosts, the careless work of chance?  
—*Mrs. Welby.*



## CHAPTER III.

### STARS THAT RISE AND SET.

\* \* \*

APRIL 1, 8 P.M.

THE Great Dipper is high in the north-east. This Dipper is only a part of the Great Bear, whose head is now on our meridian, north of our zenith, and his fore feet come almost to our zenith. The Lion's head reaches nearly to our meridian, while his body extends for thirty degrees toward the east. Start from Deneb, in the Lion's tail, and go toward the last star in the Dipper handle. When about one-third of the way you pass near a faint cluster of stars called Berenice's Hair (Coma Berenices). In moonlight this cannot be seen, but on a clear, moonless night you may see it to advantage. About half-way from this group to the last star in the Dipper handle you pass a fine star of the third magnitude, in

the body of one of the little Dogs with which Bootes is chasing the great Bear around the pole. The English astronomers have named this star Cor Caroli (the Heart of Charles), after their unfortunate king, Charles I.

There they stand,  
Shining in order, like a living hymn  
Written in light. —*Willis.*

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APRIL 10, 8 P.M.

About half-way from our zenith to the south point of the horizon our meridian passes very near a star of the second magnitude. Being in rather a dreary region of the sky, this star may be readily found. It is the heart of the Water Snake (Hydra). This constellation has no other bright star. It winds about for many degrees, its head being under Cancer, while its body reaches to our south-eastern horizon. Nearly half-way up in our south-eastern horizon there are a few stars of the third magnitude, forming the Crow (Corvus), which stands on the Water Snake.

The Milky Way lies above the western horizon, beginning at the southern point in the constellation Argo Navis. It passes near Sirius (low down in the south-west), and then above Orion and below Bootes, crossing Perseus and sinking below the horizon in the north-west, in the constellation Cassiopeia. This beautiful "river of light" varies in width and in brightness at different stages in its course.

Touched by a light that hath no name,

A glory never sung;

Alike on sky and mountain wall

Are God's great pictures hung.

—*Whittier.*

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APRIL 20, 8 P.M.

A little below our zenith the meridian passes through the Lion. This is the large Lion. Above him, on our zenith, is the Smaller Lion, made up of a few stars, none of them above third magnitude. He lies between the larger Lion and the feet of the Great Bear. Over in the east, about half-

way between the meridian and horizon, is the constellation Virgo. About twenty degrees from the horizon is the brightest star in Virgo. This is Spica, being represented on maps and globes as a sheaf in her hand. This star of the first magnitude may be readily found, as there is no bright star near it. Spica in the east, Arcturus in the north-east, and Deneb (in the Lion's tail) a little east of the meridian, form a large, equal-sided triangle; or Spica, with Denel and a bright star in the Crow (Corvus), in the south-east, form another large triangle.

Go from Spica toward the Dipper, and when nearly half-way you come to a rather bright star, marking the other hand of Virgo. Her feet are toward the eastern horizon, and her head reaches nearly to the Lion's tail.

This fine constellation can be seen, at early hours, from February to September.

Virgo is bounded on the north by Como, Berenice, and Auriga, east by Libra, south



by the Crow and other small constellations, and west by Leo.

In 1847 Daniel Webster visited several of the Southern States. From Richmond, Va., he wrote a letter to his sister, from which we copy a few paragraphs for their beauty:

RICHMOND, April 29, five o'clock A.M., 1847.

It is morning, and a morning sweet and fresh and delightful. Everybody knows the morning in its metaphorical sense, applied to so many objects and on so many occasions. The health, strength, and beauty of early years lead us to call that period the "morning of life." Of a lovely young woman we say that she is as "bright as the morning;" and no one doubts why Lucifer is called "son of the morning." But the morning itself few people, inhabitants of cities, know any thing about. Among all our good people of Boston not one in a thousand sees the sun rise once a year. They know nothing of the morning. Their idea of it is that it is that part of the day which comes along after a cup of coffee and a beefsteak or a piece of toast. With them morning is not a new issuing of light; a new bursting forth of the sun; a new waking up of all that has life from a sort of temporary death, to behold again the works of God, the heavens and the earth. It is only a part of the domestic day, belonging to breakfast, to

reading the newspaper, answering notes, sending the children to school, and giving orders for dinner. The first faint streak of light, the earliest purpling of the east which the lark springs up to greet, and the deeper and deeper coloring into orange and red, till at length the "glorious sun is seen, regent of day." This they never enjoy, for this they never see.

Beautiful descriptions of the "morning" abound in all languages, but they are the strongest, perhaps, in those of the East, where the sun is so often an object of worship. King David speaks of taking to himself "the wings of the morning." This is highly poetical and beautiful. The "wings of the morning" are the beams of the rising sun. Rays of light are wings. It is thus said that the Sun of righteousness shall arise "with healing in his wings," a rising sun which shall scatter light and health and joy throughout the universe. Milton has fine descriptions of morning, but not so many as Shakespeare, from whose writings pages of the most beautiful images, all founded on the glory of the morning, might be filled.

I never thought that Adam had much advantage of us from having seen the world while it was new. The manifestations of the power of God, like his mercies, are "new every morning" and "fresh every evening." We see as fine risings of the sun as ever Adam saw, and its risings are as much a miracle now as they were in his day; and I think a great deal more, because

it is now a part of the miracle that for thousands and thousands of years he has come to his appointed time, without the variation of a millionth part of a second. Adam could not tell how this might be.

I know the morning. I am acquainted with it, and I love it, fresh and sweet as it is, a daily new creation breaking forth and calling all that have life and breath and being to new adoration, new enjoyments, and new gratitude.

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MAY 1, 8 P.M.

Tennyson, describing an event in May, says:

It fell on a time of year

When the shining daffodil dies, and the Charioteer  
And starry Gemini hang like glorious crowns  
Over Orion's grave, low down in the west.

Look over in the west to-night. Orion is sinking into his western grave. Part of this brilliant constellation is already below the horizon. Half-way up to the meridian you can see the "starry Gemini." The feet of the Twins reach to the upper edge of the Milky Way. They will soon plunge beneath the horizon, feet foremost. Over in the north-east is the brilliant Capella, in Auriga,

the Charioteer. Low down in the southwest, very near the horizon, is Sirius, the flaming Dog Star; and very near the northeastern horizon is Vega, in the Lyre. High up in the east is Arcturus; and south of Arcturus about thirty degrees (the line joining them being now nearly parallel to the horizon) is Spica, in the Virgin's hand. Thus we have a number of brilliant stars in view at once. Some of them are near the horizon, where they twinkle or scintillate more than when higher up. This adds to the beauty of the stars, and is worth noticing particularly. You may see different tinges of color in the flashing, beautiful orbs. At some stages or conditions of the atmosphere this twinkling is more striking than at others. It has been supposed that some of the brightest stars twinkle less than others, owing to their various colors, perhaps—Vega, for example, twinkling less than Arcturus.

When a star is represented in a picture, it is not by a round dot; but there are cor-

ners, angles, or wings added. This is to make the picture like that which we see when we look at a bright star. The Egyptians always made five wings when representing stars. It is strange that different persons see different numbers. Humboldt always saw eight, while some of his friends saw three or four on the upper part of the star, and none below. How many do you see?

In places near the equator the stars twinkle less than with us, and when near the zenith cease twinkling entirely.

Twinkle, twinkle, little star;  
How I wonder what you are:  
Up above the world so high,  
Like a diamond in the sky.

Montague Stanley (1809-44) was delighted with this familiar verse, and wrote the following companion lines for his little boy to sing:

Who was it made thy tiny light,  
Sparkling in the darkest night?  
Whose hand doth hold thee up so far,  
When thou twinklest, little star?

'Twas God who made thee shine so bright,  
The God who gave me life and light;  
And though you're beautiful, bright star  
Yet God doth love me better far.

For Jesus spake the word, and thou  
Didst shine at first, as thou dost now;  
But O *that* Jesus died for me,  
And thus God loves me more than thee.

And though thou lookest bright and free,  
Thou wilt wax old, and changed shalt be;  
But God shall make me brighter far,  
When thou art faded, twinkling star.

---

MAY 10, 8 P.M.

The Great Dipper is on our meridian, between the North Pole and our zenith, the handle being toward our right as we face the north. The feet of the Bear come down to our zenith, or even a little below it. About thirty degrees below our zenith the fine constellation Virgo begins, and stretches thirty degrees toward the east. About twenty degrees east of our meridian, over in the south-east, is a bright star, Spica, the brightest in the constellation. The bright star,

Deneb, in the Lion's tail, is on our meridian, a few degrees below our zenith. Over in the north-east is a very bright star, forming with Spica and Deneb a large triangle, nearly equal sided. This very bright star is Arcturus, in the knee of Bootes, whose head is toward the north, his body being now nearly parallel to the horizon. The last two stars in the handle of the Great Dipper point nearly toward Arcturus. This is a yellowish star of great beauty that has been famous in all ages.

Bootes drives the Great Bear around the pole. He has two little dogs between him and the Bear. A little more than half-way from Arcturus to the southern one of the two pointer stars (in the western end of the Great Dipper) is a rather bright star (Charles's heart, Cor Caroli) in one of these dogs.

The name Arcturus means "tail of the bear," as this bright star follows the Bear closely.

Arcturus rises about sunset early in May, and sets quickly after sunset early in October. During the summer and fall months this beautiful star is seen at convenient hours.

Bootes is bounded on the north by smaller constellations, east by the Northern Crow and Hercules, south by Virgo, and west by Coma Berenices, his dogs, and the Great Bear.

Two and a half centuries ago, when the telescope was invented, the astronomers of that day were surprised to find that with its help stars could be seen by daylight. Arcturus was the first star thus seen through the small telescope of that day. With the better instruments now in use stars of the smaller grades are readily seen in the daytime.

There is a popular belief that stars may be seen by day, with the naked eye, from the bottom of a well. The reader may ask intelligent well-diggers about this opinion.



One star differeth from another star in glory.

—*Paul.*

Canst thou guide Arcturus with his sons?

—*Job xxxviii. 32.*

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MAY 20, 8 P.M.

A few degrees south of our zenith, very near the meridian, is the faint cluster of stars called Coma Berenice, or the Lock of Berenice. Below this, on the western side of the meridian, is Deneb, in the tail of the Lion. Deneb, Coma Berenice, Cor Caroli, and the last star in the Dipper handle are in a line from south-west to north-east.

Below Deneb our meridian passes over the Virgin's shoulders, her body reaching eastward. Farther south, about thirty degrees above the horizon, the meridian passes through a group of stars, the brightest three being of the third magnitude. This little constellation is Corvus, the Crow.

At the south point of the horizon our meridian passes through Centaurus, a large constellation of which the brightest stars are

not visible except to those living in Florida. Persons living low down in this State can see several stars of the first magnitude, which are always below the horizon to the inhabitants of other portions of our country. Portions of that beautiful constellation, the Southern Cross, are seen from Lower Florida at this hour, rising a few degrees above the southern point of the horizon. Twilights are now becoming longer. In higher latitude, as England, twilight now lasts all night, morning twilight beginning before evening twilight ceases. This cannot take place in any part of the United States.

Behold this midnight glory: worlds on worlds!  
Amazing pomp; redouble this amaze!  
Ten thousand add; add twice ten thousand more;  
Then weigh the whole: one soul outweighs them all,  
And calls the astonishing magnificence  
Of unintelligent creation poor. —*Young.*

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JUNE 1, 8 P.M.

Several fine stars of the first class may be seen at this hour. Low down in the north-

east is Arided, in the Swan or Northern Cross. This bright star marks the northern end of the long beam of the cross, which is now parallel with the horizon, and is traced by several stars, nearly in a straight line, running down the Milky Way. Very near the eastern edge of the horizon is Altair, in the Eagle, midway between the fainter stars, the three making a straight line pointing toward the horizon. Vega is in the north-east. Low down in the south-east is Antares, in the Scorpion. Nearly overhead is Arcturus, in Bootes. Lower down, nearly on our meridian, is Spica, in the hand of the Virgin. Over in the west, midway, is Regulus, in the Lion's breast. Very near the western horizon is Procyon. In the north-west are Castor and Pollux, in the heads of the Twins, who are now ready to sink, feet foremost, below the western horizon. Very low down in the north-west is Capella, in Auriga, the Charioteer.

Between our zenith and the North Pole

our meridian cuts the Dipper, the handle being on our right and the bowl of the Dipper on our left.

Vega, Capella, and Arcturus are usually considered the three brightest stars north of the celestial equator.

The sun and every vassal star,  
All space beyond the soar of angel wings,  
Wait on His word; and yet he stays his car  
For every sigh a contrite suppliant brings.

—Keble.

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JUNE 10, 8 P.M.

The fine constellation Bootes is now overhead. His dogs are west of our meridian, close behind the Bear, and the body of Bootes reaches northward. Arcturus, his brightest star, is very near our zenith, to mark his knee.

Near our meridian, a little to the west, about half-way from our zenith to the southern horizon, is Spica. The Virgin's head lies westward, her feet pointing eastward. About fifteen degrees above our southern

horizon the meridian passes through a cluster of rather bright stars in the head of Centaur, a large constellation whose greater part never rises above our horizon. The Milky Way lies low along the eastern horizon, from Cassiopeia on the north to Scorpio on the south. In the north-east the Northern Cross (Swan) lies parallel to the horizon in the Milky Way. Altair, in the Eagle (Aquila), is just above the eastern horizon, the line of three stars of which it is the center pointing downward. The tail of the Eagle reaches to the Milky Way above. As Altair rises in the east Procyon sets in the west. With a clear horizon in both directions both may be seen for a short time above the horizon. Six months hence Procyon will be rising at this hour in the east, while Altair will be setting in the west.

Then sorrow touched by Thee grows bright

With more than rapture's ray,

As darkness shows us worlds of light

We never saw by day.

—*Tom Moore.*

JUNE 20, 8 P.M.

The bright star Arcturus is now on our meridian, a few degrees below our zenith. Thirty degrees below the meridian passes nearly midway between two bright stars—Spica on the west and Antares on the east. Antares is a few degrees lower down toward the horizon. Between these two stars lies the constellation Libra, our meridian passing through its western edge. There are no stars of the first magnitude in this constellation. It is, however, one of the zodiac constellations, through which the moon passes every month, the sun once every year, and every planet once in its circuit. The brightest four stars form an irregular figure. One of them is seen by some eyes to have a beautiful light-green color.

Our days are now at their longest. In Florida the longest day is fourteen hours long; in Maine it is more than fifteen hours in length; in the lower part of Alaska it is seventeen hours long; and in the higher por-

tion of our new territory there are twenty-four hours of continuous sunshine.

The sun now rises farther round to the north-east, and sets farther to the north-west, than at any other time of the year.

Thomas Buchanan Read, an American poet (1822-72), has some lines worth remembering when we watch the silent motion of the stars as they sink toward the west:

PROCESSION OF STARS AND SOULS.

I stood upon the open casement,  
And looked upon the night,  
And saw the westward-going stars  
Pass slowly out of sight.

Slowly the bright procession  
Went down the gleaming arch,  
And my soul discerned the music  
Of the long, triumphal march;  
Till the great celestial army,  
Stretching far beyond the poles,  
Became the eternal symbol  
Of the mighty march of souls.

Onward, forever onward,  
Red Mars led on his clan;

And the moon, like a mailed maiden,  
Was riding in the van.

And some were bright in beauty,  
And some were faint and small;  
But these might be, in their great heights,  
The noblest of them all.

Downward, forever downward,  
Behind earth's dusky shore,  
They passed into the unknown night;  
They passed, and were no more.

No more! O say not so!  
And downward is not just;  
For the sight is weak and the sense is dim  
That looks through heated dust.

The stars and the mailed moon,  
Though they seem to fall and die;  
Still sweep in their embattled lines  
An endless reach of sky.

And though the hills of Death  
May hide the bright array,  
The marshaled brotherhood of souls  
Still keeps its onward way.

Upward, forever upward,  
I see their march sublime,  
And hear the glorious music  
Of the conquerors of time.



And long let me remember  
That the palest fainting one  
May to diviner vision be  
A bright and blazing sun.



## CHAPTER IV.

### STARS THAT RISE AND SET.

\* \* \*

JULY 1, 8 P.M.

THE Milky Way is very conspicuous now every clear night when no moon is shining. It begins in the north-east, where Cassiopeia is rising. Two streams can be traced, with a space of open sky between, and in each stream sometimes dark spots may be seen between the brighter portions. The two branches can be traced, more or less distinctly, down to the southern horizon, where there is now a brilliant portion of this wonderful circle, with Scorpio on one side and Sagittarius on the other. A little close and careful looking at this splendid object will bring out beauties which the hurried observer does not find.

*Galaxy* is from a Greek word meaning "milk," and is a name frequently used.

Most of our brightest stars lie in or near the Milky Way. Part of this wonderful belt is now below our horizon. We must wait for some winter night to bring it before us.

A great part of the Milky Way is made up of stars too distant for us to see them distinctly one by one. This strange belt has been gazed at by the man of science, the poet, the philosopher, and the child, with wondering eyes. It has been called the "celestial river," "the path of departed spirits to the better land," "Jacob's Ladder," etc.

Torrent of light and river of the air,  
Along whose bed the glimmering stars are seen,  
Like gold and silver sands in some ravine  
Where mountain streams have left their chasms bare;  
The Spaniard sees in thee the pathway where  
His patron saint descended in the sheen  
Of his celestial armor, on serene  
And quiet nights, when all the heavens were fair.  
Not this I see, nor yet the ancient fable  
Of Phæton's wild course that scorched the skies,  
Where'er the hoofs of his hot coursers trod;

But the white drift of worlds o'er chasms of sable—  
The star-dust that is whirled aloft, and flies  
From the invisible chariot-wheels of God.

—*Longfellow.*

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JULY 10, 8 P.M.

A few degrees south of our zenith is a small constellation which can be learned with a little trouble. It is the Northern Crown, made up of a half-circle of stars that may be traced very clearly. There are no stars of the first magnitude in the crown, the brightest only being of the second magnitude. This is called Alphacca, or "the pearl" of the crown. In 1866 one of the smallest stars in the crown suddenly flared up to the second magnitude. After burning with this unusual luster for several weeks, it suddenly sunk down, and now it cannot be seen with the naked eye. A star on fire! What could this be?

There have been other instances of stars suddenly appearing. In November, 1572, a very bright star appeared in Cassiopeia.

It became bright enough to be seen in broad daylight. After a year or more it disappeared. This led astronomers to look back into recorded notices of similar occurrences. It was found that several stars had appeared at intervals of about three hundred and fourteen years. Counting backward, that made one probable about the Christian era, and by some this was connected with the Star of Bethlehem. The year 1886 was the date for the re-appearance of this star. On this slender foundation of fact and fancy all the expectation of the Star of Bethlehem re-appearing has been based.

And that special arrangement of the material system is peculiarly worthy of notice which, while all intercourse between neighboring worlds is effectively prevented, allows the vastness of the creation to be a spectacle to each part of it. In truth, nothing in physical philosophy is so amazing as the means by which objects much more remote one from the other than the utmost range of calculation can extend to are made perceptible one to the other. If the mere greatness of creation is wonderful, there is even a higher or more superlative wonder in the fact that this greatness should

be cognizable from every point, or that at any point where a percipient being may have his station, thither as to a center the lines of knowledge should converge; so that the mind of that being should gather to itself true and distinct notices of whatever floats within the immeasurable sphere of stellar light.—*Isaac Taylor.*

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JULY 20, 8 P.M.

About thirty degrees from our southern horizon our meridian passes very near to a bright, reddish star of the first magnitude. This is Antares, which seems to mean Anti-Mars, or Mock-Mars. The color of this star makes it easily mistaken for the fiery planet. Once in two years Mars passes through Scorpio, and sometimes he passes very near to the star, as was the case in August, 1890. Antares is the heart of the Scorpion, his head being traced by a curve of stars above, while the body stretches down through the western branch of the Milky Way; and when near the horizon a row of bright stars turns to the east, and then upward in the other branch of the

Milky Way. This constellation is often called the Kite. A very good resemblance can be traced from the upper curve of stars from the rim to the long curved tail ending in two bright little stars near the edge of the Milky Way.

This is perhaps the finest one of our summer constellations, and is seen at early hours from the middle of April to the middle of October.

Scorpio and Sagittarius (east of Scorpio) extend farther toward the southern horizon than the other zodiac constellations. When low down in the south-west, Scorpio lies almost parallel to the horizon.

Vega, in Lyra; Altair, in the Eagle; and Arided, in the Swan, form a large triangle of first-class stars.

If at this season of the year the reader happens to travel all night, or to rise very early, he will be glad to see the bright winter constellations. About 4 o'clock in the morning he can see the Seven Stars high up

in the east, Orion below, and Sirius near the horizon.

One can never be alone if he is familiarly acquainted with the stars. He rises early in the summer morning, that he may see his winter friends; in the winter, that he may gladden himself with a sight of the summer stars. He hails their successive rising as he does the coming of his personal friends beyond the sea. On the wide ocean he is commercing with the skies, his rapt soul sitting in his eyes. Under the clear skies of the East he hears God's voice speaking to him, as to Abraham, and saying: "Look now toward heaven, and tell the stars if thou be able to number them."—*Bishop Warren.*

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### AUGUST 1, 8 P.M.

Overhead is the very large constellation Hercules. Our zenith is nearly in the center, and the great cluster stretches for twenty degrees north along the meridian, and about as far south; while it extends about ten degrees on each side. His head is toward the south, his feet reaching toward the North Pole.

There are no first-class stars in this great



constellation, and only one of the second. This one is in the head, about twenty degrees south of our zenith. You may find it, with the help of a star of equal brightness, about five degrees east. This second star is the head of another giant (Serpentarius, the serpent-bearer), whose body extends for many degrees down toward the Milky Way and Scorpio. The star in the head of Serpentarius and Lyra, east of our zenith, and Altair to the south-east, form a triangle of nearly equal sides. The body of Serpentarius extends along the Milky Way to Scorpio. The foot of Hercules is on the Dragon's head, far to the north.

Hercules is bounded on the north by the Dragon, east by Lyra and the Milky Way, south by Serpentarius, and west by the Northern Crown and Bootes.

Serpentarius is bounded on the north by Hercules, east by the Milky Way, south by the Scorpion, and west by Libra and Bootes.

There are some reasons for believing that the Sun, with all his family of planets (our world among them) is moving at present toward the constellation Hercules. Thomas Carlyle has a good paragraph on this subject:

On the whole, as this wondrous planet, Earth, is journeying with its fellows through infinite space, so are the wondrous destinies embarked on it journeying through infinite time, under a higher guidance than ours. For the present, as our astronomy informs us, its path lies toward Hercules, the constellation of physical power. But that is not our most pressing concern. Go where it will, the deep heaven will be around it. Therein let us have hope and sure faith. To reform a world, to reform a nation, no wise man will undertake; and all but foolish men know that the only solid though far slower reformation is what each man begins and perfects in himself.

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AUGUST 10, 8 P.M.

The right knee of the giant Hercules is over our head to-night. His foot toward the north is on the head of the Dragon, which is on our meridian about twenty degrees

north of our zenith. The Dragon's head is made up of four bright stars, forming an irregular figure, the sides being from six to eight degrees in length. The two stars forming the upper side are the brightest, and the right-hand one is a famous star. It passes over the zenith of Greenwich, and is connected with a remarkable discovery of the royal astronomer, Bradley. Twenty degrees south of our zenith the meridian passes over the bright star in the head of Serpentarius. His body lies along our meridian for thirty degrees or more. He holds in his hands a serpent, whose long body coils around through many degrees, stretching across the meridian eastward, and reaching nearly to Arcturus, west of the meridian. This Serpent's head is about midway from the heads of Hercules and Serpentarius to Arcturus.

It is usually better to study the stars on a moonless night, as the smallest stars are then visible; but the stars of first and sec-

ond magnitude are more readily learned in the presence of the moon, as the stars are not so crowded then.

The Moon was pallid, but not faint,  
And beautiful as some fair saint  
Serenely moving on her way  
In hours of trial and dismay.  
As if she heard the voice of God,  
Unharm'd, with naked feet she trod  
Upon the hot and burning stars,  
As on the glowing coals and bars  
That were to prove her strength and try  
Her holiness and her purity. —*Longfellow.*

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#### AUGUST 20, 8 P.M.

Four or five degrees east of our zenith there is a bright star—one of the brightest in all the northern sky. This is Vega, or Wega, in the little constellation Lyra. The star is sometimes called by the name of the constellation. Strictly, however, Vega is the brightest star in the constellation Lyra. About eight degrees south of Vega are two rather bright stars two degrees apart.

These mark the southern extremity of the Harp (Lyra). Two degrees east of Vega are two faint stars, which with Vega form a small, equal-sided triangle. Look closely, when there is no moonlight, at the northern one of the faint stars. A keen eye sees it like a "long or flattened star." Some very good eyes separate it into two stars. A little opera-glass divides it, and a small telescope separates *each* of these two very faint stars into two.

Vega is a beautiful star, described by one astronomer as "a pale sapphire, or tinged with blue—a lovely gem." Vega, with us, rises about forty degrees east of the north point of the horizon. It is seen at early hours from the first of April to the middle of January. In London it is in the circle of never-setting stars.

Only four stars of the first magnitude pass immediately over the United States. Capella and Arided once in every twenty-four hours are in the zenith to the inhabitants of

Maine. Pollux is overhead to the people of lower South Carolina and the Gulf States. Vega passes over Washington, D. C.; Lexington, Ky.; St. Louis, Mo.; and other places in that line of latitude. Between two successive appearances to us that bright star visits the "Old World," and looks directly down on the Fortress of Gibraltar, Corinth and Athens in Greece, and the ruins of Ephesus in Asia Minor.

The sky in midsummer may not have the peculiar splendor of the winter nights, for one season differeth from another season in glory; but to-night there are many objects to move our wonder and reverence. Three first-class stars are in the west. Arcturus, in Bootes, is high up; while Spica, in Virgo, is low down near the horizon, and farther toward the south; and higher up, in Antares, is Scorpio.

The Milky Way begins a little east of north, while Perseus is beginning to rise, and passes through Cassiopeia, dividing

into two streams, one of them (the upper) including the Northern Cross (Swan), the other passing over the Eagle. These branches of the Milky Way differ in width from three or four degrees in some places to twelve degrees or more in others. One of them sinks below the horizon at the south point; the other a little farther west, near Scorpio.

The two great circles—the ecliptic and the equator—now cut each other in the eastern and western points of the horizon.

The equator in the sky is only the earthly equator prolonged. Begin at the north pole of the sky, and go ninety degrees in any direction, and you reach the celestial equator. If it were a visible instead of an imaginary line, one-half of it would be seen spanning the sky, perpetually, by day and by night. The half of it overhead now is not traced by any remarkable star. It passes a few degrees south of Altair, in the Eagle.

If we could see the stars that are over-

head by day, we would notice different clusters near the sun from day to day. Year after year he passes over exactly the same path, through the same constellations. This path, traced on the sky, is the ecliptic. The moon and planets do not follow the same path, though they never wander far from it. A belt of about eight degrees on each side of the ecliptic includes the paths of the planets and the moon. The constellations in this belt bear the names of animals—such as the Ram, the Bull, etc. These constellations are called the *zodiac*, from a Greek word meaning *animals*. One-half of the zodiac, made up of *six* constellations, is always visible at night. To-night, beginning in the west, we can see Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and part of Pisces. The two great circles meet in the east and west to-night in an angle of about twenty-three and a half degrees.

The twelve constellations in the zodiac, beginning with Aries, the Ram, are given



by their English name in the following verse:

The Ram and Bull lead off the line;  
Next Twins and Crab and Lion shine  
The Virgin and the Scales:  
Scorpion and Archer next are due,  
The Goat and Water-bearer too,  
And Fish with glittering tails.

Aries is on the meridian at 8 P.M., about the 1st of January; Taurus, about the 1st of February; and so on through the twelve months of the year. Gemini (the Twins) are the highest, when on the meridian, of all the zodiac constellations. They pass overhead to the people of the Gulf States. Sagittarius is lowest, rising less than one-third of the way up from the southern horizon to the zenith, to the middle portions of our country.

Casper Hauser, a German, was cruelly confined in a dark dungeon from infancy to young manhood. When released, in 1828, he was perhaps seventeen years of age. He

was a child in all respects, as to the use of the senses. Great care was taken to accustom him to the view of all objects, near or distant. After months of training, his keeper thought it time to show him the skies by night. The following paragraph is taken from the teacher's account of his pupil:

It was in the month of August, when on a fine summer evening his instructor showed him for the first time the starry heavens. His astonishment and transport surpassed all description. He could not be satiated with the sight, and was ever returning to gaze upon it; at the same time fixing accurately with his eye the different groups that were pointed out to him, remarking the stars most distinguished for their brightness, and observing the difference in their respective colors. "That," he exclaimed, "is indeed the most beautiful sight that I have ever yet seen in the world! But who placed all these numerous beautiful candles there? Who lights them? Who puts them out?" At length, standing motionless, with his head bowed down and his eyes staring, he fell into a train of deep and serious meditation. When he again recovered his recollection, his transport had been succeeded by deep sadness. He sunk trembling upon a chair, and asked why that wicked man had kept him locked up, and had never shown him

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any of these beautiful things. He (Casper) had never done any harm. He then broke out into a fit of crying, which lasted for a long time, and which could with difficulty be soothed; and said that the man with whom he had always been may now be locked up for a few days, that he may learn how hard it is to be treated so." This was the first occasion on which he seemed to feel any indignation at his cruel treatment.

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SEPTEMBER 1, 8 P.M.

About thirty degrees above the southern horizon our meridian passes through a fine constellation — Sagittarius. There are no first-class stars in this constellation, yet it is a striking cluster on the whole. Several of its brightest stars (second or third magnitude) are now on our meridian, forming a Dipper, in shape something like the Great Dipper, only smaller. It is "bottom upward," and the handle stretches toward the west, in the Milky Way. This group of stars is sometimes called the Milk Dipper. This constellation, with the neighboring patches of light and islands of darkness in

the Milky Way, makes a striking picture on a clear, moonless night.

The famous traveler Du Chaillu describes the enjoyment which he received from a study of the stars, as they looked down upon him when in Central Africa:

The contemplation of the heavens afforded me a degree of enjoyment difficult to describe. When every one else had gone to sleep, I often stood alone on the prairie, with a gun by my side, watching the stars. I looked at some with fond love, for they had been my guides, and consequently my friends, in the lonely country I traveled; and it was always with a feeling of sadness that I looked at them for the last time, before they disappeared below the horizon for a few months; and I always welcomed them back with a feeling of pleasure which, no doubt, those who have been in a situation similar to mine can understand. I studied also how they twinkled, and tried to see how many bright meteors traveled through the sky until the morning twilight came, and reminded me that my work was done by the then visible world becoming invisible.

Dr. Kane found similar enjoyment under the polar skies:

The intense beauty of the entire firmament can hardly be imagined. It looked close above our heads,

with its stars magnified to glory, and the very planets twinkled so much as to baffle the observation of the astronomer. I have trodden the deck, when the life of the earth seemed suspended—its movements, its sounds, its coloring, its companionship; and as I looked on the radiant hemisphere circling above me, as it rendering worship to that unseen center of light, I have ejaculated, in humility of spirit: "Lord, what is man, that thou art mindful of him?" And then I have thought of the kindly world we had left, with its revolving sunlight and shadow, and all the other stars that gladden it in their changes, and the hearts which warmed to us there, till I lost myself in memories of those who are not, and they bore me back to the stars again.

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SEPTEMBER 10, 8 P.M.

A few degrees south of our zenith, on our meridian, is a bright star, forming the head of the Swan (Cygnus), a beautiful constellation now lying east of our meridian for several degrees. About twenty-five degrees to the north-east of this bright star is one still brighter, in the tail of the Swan, called Arided. Along the line joining these two bright stars you may trace a row of smaller

stars forming the long beam of a cross. Near the northern end, a few degrees south of Arided, there are two bright stars, equally distant from the central line, forming the cross-piece. Altogether this Northern Cross is a beautiful figure, and it is striking in its outline when once clearly seen. It gives name to the constellation which is called the Northern Cross more frequently than the Swan.

The Southern Cross is below the horizon to us at all times, except that a small part of it can be seen at one season of the year by those persons who live in Florida.

Arieded is in a small dark patch or island in the Milky Way. The long beam of the Cross lies along the Milky Way. When rising in the north-east, the cross is lying parallel to the horizon; when setting in the north-west, it is upright.

In the eastern part of this constellation there is a small star, which for reasons that cannot be given here is supposed to be

nearer to us than any star north of the equator. It is so distant that its light requires about ten years to reach us. When you look at the stars, you do not see them as they are *to-night*, but as they were years ago—perhaps in some cases as they were many years ago. Light requires more than thirty years to reach us from the North Star. If that star should be suddenly blotted from existence by its Creator, we would not miss it for thirty years.

Were a star quenched on high,  
For ages would its light,  
Still traveling downward from the sky,  
Shine on our mortal sight.

So, when a great man dies,  
For years beyond our ken  
The light he leaves behind him lies  
Upon the paths of men. —*Longfellow.*

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SEPTEMBER 20, 8 P.M.

Twenty degrees south of our zenith, and a few degrees east of our meridian, is the little group of small stars called, from their

shape, Job's Coffin. This is the Dolphin. West of this, on the other side of the meridian, is the constellation Aquila, or the Eagle. This cluster has one star of the first magnitude, "of a ruddy color," called Altair. It lies between two smaller stars, equally distant in a straight line on each side. Altair is in the neck of the Eagle, its tail extending to the Milky Way, toward Lyra.

Our days and nights are now equal. Twilight is short.

The sun is now crossing the equator, going southward. When he is on the equator, his light reaches to both poles, north and south. When he goes south of the equator his light is withdrawn from the North Pole, and its long night begins, while the South Pole enjoys constant sunshine for as long a time. Spring is now beginning to those countries south of the equator. That they may have their spring and summer, we must now have our fall and winter. Their days are becoming longer, while ours be-



come shorter; yet to every spot on the earth's surface one-half of the year is light, and the other half darkness.

The soul that sees him, or receives sublimed  
New faculties, or learns at last to employ  
More worthily the powers she owned before,  
Discerns in all things what with stupid gaze  
Of ignorance till then she overlooked:  
A ray of heavenly light, gilding all forms  
Terrestrial in the vast and the minute;  
The unambiguous footsteps of the God  
Who gives its luster to an insect's wing,  
And wheels his throne upon the rolling worlds.

—*Cowper.*



## CHAPTER V.

### STARS THAT RISE AND SET.

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OCTOBER 1, 8 P.M.

THE Northern Cross is overhead. The bright star Vega is west of the meridian. Below our zenith, on the meridian, are the Dolphin (Job's Coffin), with the Eagle next on the west. About half-way from this point to the southern horizon the constellation Capricornus lies on both sides of our meridian. The head is known by two stars of the third magnitude, a little west of our meridian, lying about three degrees apart; the northern one of them being a double star, when looked at closely with the naked eye.

Vega (in Lyra) is east of our zenith. A line from this bright star to the head of Capricornus will pass through Aquila, the Eagle. The three brightest stars in the Eagle (Al-

(100)

tair being the middle one) are about half-way between Lyra and Capricornus, and point nearly toward these constellations.

On the surface of a world which is a mote, and over-arched by an infinitude alive with these lustrous forms, *man* can turn his eyes to his feet, and *there* is the insect with its nest and the floweret blooming in peace. Yes, if awed into dread by these majestic glories, or amid their surpassing splendor fearing lest a darkness should be thrown around the dwelling of my soul, I revert to that home picture of Luther's, in which he speaks of the little bird that on summer evenings came to his pear-tree at sunset and sung ever joyously and without one note of misgiving, because, though great eternity was above, below, and around it, God was there also.

—*Nichol.*

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### OCTOBER 10, 8 P.M.

Look down the meridian about half-way from the zenith to the southern horizon, and you will find the head of Aquarius, the Waterman, his body reaching half-way down to the horizon, and lying chiefly along the eastern side of the meridian. This constellation includes more than one hundred stars, but no one of them is brighter than of the third

magnitude, The brightest are in a group making the urn, from which he pours out a stream of water. This urn is a few degrees east of the head.

A line from the north-eastern corner of the square of Pegasus to the south-western corner, and continued about as far beyond, will reach this urn.

Mysterious night! when our first parents knew  
Thee from report divine, and heard thy name,  
Did he not tremble for this goodly frame,  
This glorious canopy of light and blue?  
Yet 'neath a curtain of translucent dew,  
Bathed in the rays of the great setting flame,  
Hesperus with the host of heaven came,  
And lo! creation widened in man's view.

Who could have thought such darkness lay concealed  
Within thy beams, O sun! or who could find,  
Whilst fly and leaf and insect stood revealed,  
That to such countless orbs thou mad'st us blind?  
Why do we then shun death with anxious strife?  
If light can thus deceive, why not life?

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—*Blanco White.*

OCTOBER 20, 8 P.M.

About twenty-five degrees above the

southern horizon, turn ten degrees toward the east from the meridian, and you will see a rather bright star, the brightest in all that region. This is Fomalhaut, in the eye of the Southern Fish. The mouth of the Fish is turned eastward. He is drinking from the stream which Aquarius pours from his urn. Fomalhaut is seen at convenient hours, from July to the close of the year.

This constellation (the Southern Fish) has no connection with the zodiac constellation Pisces, the Fishes.

Being in a neighborhood of rather inferior stars, Fomalhaut is quite conspicuous for several months in our southern sky. It is usually classed with the *white* stars—like Regulus, Deneb, and the Pole Star. The English astronomer Lockyer arranges other leading stars as follows, with regard to color:

*Red*—Aldebaran, Antares, Betelgeuse.

*Blue*—Capella, Rigel, Bellatrix, Procyon, Spica.

*Green*—Sirius, Vega, Altair.

*Yellow*—Arcturus.

These colors may seem to vary slightly with different states of the atmosphere. Differences in color are more “striking in countries where the atmosphere is less humid and hazy than ours. In Syria, for instance, one star shines like an emerald, another as a ruby, and the whole heavens sparkle as with various gems.”

Bellatrix, in the list of blue stars, is the western shoulder of Orion.

Two things there are which the oftener and the more steadily we consider fill our minds with an ever new, ever rising admiration and reverence: the starry heavens above and the moral law within.—*Kant*.

Two things I contemplate with ceaseless awe—

The starry heavens and man's sense of law.

—*Anon.*

The heavens declare the glory of God!

The law of the Lord is perfect. —*David.*

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NOVEMBER 1, 8 P.M.

A few degrees south of our zenith the me-

ridian passes through two bright stars about five degrees apart, lying nearly east and west. These are in the forelegs of Pegasus, the Winged Horse. The eastern one of these two stars is the north-western corner of a remarkable square. South of it about twelve degrees is another corner star; and east of these you may readily find the remaining two—the four stars of nearly equal brightness forming a regular square, each side of which is about twelve degrees.

Within this square, on a very clear night, some persons have counted nearly one hundred stars, though none of them are as bright as the corner stars.

The head of the Horse reaches toward the Dolphin (Job's Coffin) over in the west. There is no body to the horse, only his shoulder and wings being pictured on globes and maps. The western side of the square points down toward Fomalhaut, now twenty-five degrees above our southern horizon.

Go from the south-eastern corner star to

the north-western, and continue the line about as far beyond, and you will be near Arided, the brightest star in the Swan, or Northern Cross. Prolong the eastern side of the square about twelve degrees southward, and you reach a blank spot in the sky which is remarkable. It is the spot from which longitude is counted in star maps. It is the Greenwich of the skies.

Arthur Helps, on the last page of his suggestive book, "Friends in Council," puts these words into the mouth of his "friend" Millerton:

Yes, I say that the whole heavens may present to superior beings the appearance of a solid body. You all recollect what Boscovich and other physical writers have said about the ultimate atoms of matter: that they do not touch, and that they have what we call repulsion for one another. That distance from each other which is requisite for the ultimate atoms of this gaunt tree we are looking upon, which yet presents a solid appearance, may find perhaps an exact parallel in the distances of these stars one from another. They may therefore, to a being who could behold them after the same fashion as we behold this tree, present the appearance of



solidity. I cannot help thinking that no space is lost, and that the whole universe is as much occupied as the space which this tree seems to occupy. There are small creatures to whom that stone appears compact, while all the rest, perhaps, that it can behold seems wide and disjointed. Yet to us these wide disjointed things are solid.

I do not know how you may take my fancies, but at any rate I trust you feel with me that there is immortal consolation in the aspect of these heavens which we are allowed to look upon—probably the greatest physical privilege permitted to man; and that from this vast contemplation we may derive some comfort for every sorrow, some alleviation for every regret, and some benign hope to throw a ray of cheerfulness into the gloomiest depth of despondency.

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NOVEMBER 10, 8 P.M.,

OR DECEMBER 1, 6 P.M.

The great square of Pegasus is nearly overhead, our meridian passing along its western side. Near the meridian, farther south, about twenty-five degrees above the horizon, is the bright star Fomalhaut. Beginning near that point on the meridian is the Whale (Cetus), which extends far to the

east, nearly to the Bull, where the Pleiades and the Hyades are shining over in the east. As befits the name, the Whale is a very large constellation, covering the larger portion of the south-eastern region of our sky to-night. There are no stars of the first magnitude, and but one of the second. This is the heart of the Whale. Going from Fomalhaut to the Seven Stars, when about half-way, you pass near this star—the brightest in all that region. The eyes of the Whale are marked by two rather bright stars, about as far apart as the two eyes of the Ram. These eyes of the Ram are now about half-way from the Seven Stars to our meridian. The eyes of the Whale are in a line nearly parallel to the line of the Ram's eyes. The Whale's eyes, the Ram's eyes, and the Seven Stars will mark out a triangle of nearly equal sides. Half-way between the heart of the Whale and the eyes is a very remarkable changeable star, which may interest the reader hereafter. Its name is

Mira, “the Wonderful.” Between the “forepaws” of the Whale there flows a double stream—Eridanus, the river Po. One branch turns upward toward Orion’s feet; the other courses southward, and then westward, where it sinks below our horizon. There is no very bright star in this constellation which is seen by us. The people in Lower Florida may see Acharnar, a star of the first magnitude, in the southern branch of Eridanus. It comes to the meridian about the same time with the eyes of the Ram.

A “falling or shooting star” attracts attention even from those who are indifferent to the splendor of the fixed stars. Several of these “falling stars,” or meteors, may usually be seen in one hour, on any evening. They are passing through space, all around our earth, in countless numbers. There are several seasons in each year when they are more likely to be seen. November 10–14 is one of those dates. On November 13, 1833, a very remarkable shower of me-

teors occurred. It was seen over the greater portion of North America. A resident of Canada describes it in this way:

My wife awoke me between 2 and 3 o'clock in the morning, to tell me that it lightened incessantly. I immediately arose and looked out of the window, when I was perfectly dazzled by a brilliant display of falling stars. As this extraordinary phenomenon did not disappear, we dressed ourselves and went to the door, where we continued to watch the beautiful shower of fire till after daylight. These luminous bodies became visible in the zenith, taking the north-east in their descent. Few of them appeared to be less than a star of the first magnitude. Very many of them seemed larger than Venus. Two of them in particular appeared half as large as the moon. I think, without exaggeration, that several hundreds of these beautiful stars were visible at the same time, all falling in the same direction, and leaving in their wake a long stream of fire. This appearance continued, without intermission, from the time I got up until after sunrise.

A planter of South Carolina says:

I was suddenly awakened by the most distressing cries that ever fell on my ears. Shrieks of horror and cries for mercy I could hear from most of the negroes of the three plantations, amounting in all to six hundred or eight hundred. While earnestly listening for the cause,





I heard a faint voice near the door calling my name. At this moment I heard the same voice saying: "O the world is on fire!" I then opened the door, and it is difficult to say which excited me most—the awfulness of the scene or the distressed cries of the negroes. The scene was truly awful, for never did rain fall much thicker than the meteors fell toward the earth. East, west, north, and south it was the same.

Looking back over the records of similar appearances, astronomers were led to expect unusual meteoric showers about 1866. On the morning of the 14th of November, 1866, there was such a display visible in England. One year later (November 14, 1867) meteors in unusual numbers were seen in some parts of the United States. Professor Loomis, of New Haven, counted five hundred meteors in one hour.

Those living in 1899 and 1900 may see another wonderful "shower of falling stars."

Early in August (6-11) meteors are frequently seen in unusual numbers.

Miss Frances Ridley Havergal witnessed

the meteoric shower of 1866 in England, and wrote this lively description of the scene:

O to raise a mighty shout,  
And bid the sleepers all come out!  
No dreamer's fancy, fair and high  
Could image forth a grander sky.  
And O for eyes of swifter power,  
To follow fast the starry shower!  
O for a sweep of vision clear,  
To grasp at once a hemisphere!

The solemn old choral of night,  
With fullest chords of awful might,  
Re-echoes still, in stately march,  
Throughout the glowing heavenly arch;  
But harmonies all new and rare  
Are intermingling everywhere.  
Fantastic, fitful, fresh, and free,  
A sparkling wealth of melody,  
A carol of sublimest glee,  
Is bursting from the starry chorus,  
In dazzling exultation o'er us.  
O wondrous sight! so swift, so bright,  
Like sudden thrills of strange delight—  
As if the stars were all at play,  
And kept ecstatic holiday;



As if it were a jubilee  
Of glad millenniums fully told,  
Or universal sympathy  
With some new dawning age of gold.

Flashing from the lordly Lion,  
Flaming under bright Procyon;  
From the farthest east upranging,  
Past the blessèd orb unchanging;  
Ursa's brilliance far outgleaming,  
From the very zenith streaming;  
Rushing, as in joy delirious,  
To the pure white ray of Sirius;  
Past Orion's belted splendor,  
Past Capella, clear and tender;  
Lightening dusky polar regions,  
Brightening pale, encircling legions;  
Lines of fiery glitter tracing,  
Parting, meeting, interlacing;  
Paling every constellation  
With their radiant revelation!  
All we heard of meteor glory  
Is a true and sober story.  
Who will not for life remember  
This night grandeur of November?

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NOVEMBER 20, 8 P.M.

A few degrees below our zenith the great

square of Pegasus lies west of our meridian. The four stars of this square, about twelve degrees apart, are easily found. The north-eastern corner star is also a part of another constellation, Andromeda. Try to trace this fine constellation lying to the north-east of the square. Begin at the south-western corner of the square, and go to the north-eastern. Now, continue that line for about twelve degrees farther, and you will be near the bright star in Andromeda's girdle. Continue the line about the same distance beyond, and you are near a bright star in her feet. For eight or ten degrees on each side of that central line the constellation extends, and includes some wonderful objects when seen in a telescope.

Three stars (one of the second magnitude, one of the third, and the other of the fourth), in a line pointing nearly north and south, form the girdle of Andromeda. Very near the northern end of this line, on a clear, moonless night, a good eye can see a re-

markable little *nebula*, or *cloud*, of very small stars, too small to be distinctly seen.

The imaginative Greek saw in the skies a vast illustrated chart of his country's fabulous history.

Andromeda has her mother, Cassiopeia, close by her on the north; and at her feet is Perseus, her deliverer; while her head rests upon the shoulder of Pegasus, the Winged Horse which brought Perseus to her rescue.—*Young*.

Before yon sun arose  
Stars clustered in the sky;  
But O how dim, how pale were those  
To his one burning eye!

So truth lent many a ray  
To bless the pagan's night;  
But, Lord, how weak, how cold were they  
To thy one glorious light!

—*Tom Moore*.

DECEMBER 1, 8 P.M.,

OR JANUARY 1, 6 P.M.

A little below our zenith the meridian passes very near two rather bright stars, about four degrees apart. The line joining

them points north-east and south-west. These are the eyes of the Ram. The western star has a fainter companion star, two degrees south of it. The body of the Ram lies eastward, reaching nearly to the Seven Stars in the shoulder of the Bull. There are no other bright stars in the Ram. It is one of the zodiac constellations, through which the moon passes monthly. Lower down, our meridian cuts the huge Whale in the middle.

Where the meridian touches the horizon a part of the constellation Phenix is visible. Only a small part is ever above our horizon, and there are no remarkable stars in it. The southern branch of Eridanus sinks below the horizon to the left of our meridian. From lower Florida a very bright star of the first magnitude can be seen — Acharnar. Even there it rises only a very little space above the south point of the horizon.

Aries is bounded on the north by Andromeda and Perseus (with some very small, un-

important constellations lying between); on the east by Taurus; on the south by the Whale; on the west by Pisces, the Fishes.

We have already given an extract from a letter written by Daniel Webster, in which he speaks of the beauties of early morning and sunrise in spring. We quote a passage from another letter, written at his home early on a winter morning:

MARSHFIELD, Tuesday Morning,  
Five o'clock, Dec. 7, 1847.

*My Dear Sir:* It is a beautiful, clear, cold, still morning. I rose at 4 o'clock, and have looked forth. The firmament is glorious. Jupiter and Venus are magnificent, "and stars unnumbered gild the glowing pole." I wish I could once see the constellations of the south, though I do not think they can excel the heavens which are over our heads. An hour or two hence we shall have a fine sunrise. The long twilights of this season of the year make the sun's rising a slow and beautiful progress. About one hour hence these lesser lights will begin to "pale their ineffectual fires." Meantime Mr. Baker and his men are already milking and feeding the cows, and his wife has a warm breakfast for them, all ready, before a bright fire. Such is country life, and such is the price paid for manly strength and female health and red cheeks.

DECEMBER 10, 8 P.M.

The head of Andromeda is very near our zenith, her body extending toward the northeast. Below our zenith the meridian leaves the great square of Pegasus a little to our right. Below the square is the zodiac constellation Pisces, having no connection with the Southern Fish, now low down in the south. Astronomers call this constellation Pisces "a dull region." It is certainly so to the naked eye, as it has no star of the first magnitude, its brightest being scarcely above the third. One Fish is below the southern side of the great square and parallel to it, while the other is several degrees east of the eastern side of this square, and parallel to it. These Fishes are bound together by a long, loose cord, in a knot of which is the brightest star in this interesting constellation.

Our days are nearly at their shortest. In Florida they are about ten hours long, while in Maine they are scarcely nine.

Night brings out stars, as sorrow shows us truths.

. . . . .

We never see the stars

Till we can see naught but them. So with truth.

— *Festus.*

DECEMBER 20, 8 P.M.

Let us take a general view of the winter constellations, now visible in all their splendor. We begin at the northern point of the horizon and go round by the east to the south, and then by the west back to the north, mentioning in order the constellations on the horizon.

Very near the northern horizon are a few faint stars in the Dragon. Then comes the Great Dipper, the lower end of the handle being cut off by the horizon to some portions of our country. In the north-east Cancer is rising. In the east the Unicorn is partly above the horizon, the bright star Procyon, in the Little Dog, being very near the horizon. Farther south the Great Dog is rising, Sirius, in his mouth, flashing very close to the horizon. Half-way from this to the south point,

just on the horizon, are a few rather bright stars in the little constellation Columba, the Dove. At the south point of the horizon the meridian passes between the Phenix on our right and a part of Eridanus on the left. Low down in the south-west is the bright Fomalhaut, in the eye of the Southern Fish. Nearer to the western point of the horizon Aquarius is ready to sink down. In the west the Dolphin (Job's Coffin) is very near the horizon. Still nearer the horizon Altair, in the Eagle, may be seen just ready to sink below it. In the north-west Vega, in Lyra, is very low down. Higher up in the north-west is Arided, in the upper end of the Northern Cross, which stands upright. The great square of Pegasus is midway up in the west; Andromeda nearly overhead, with Cassiopeia between her and the North Star. Perseus is a little north of our zenith; and Bootes, with Arcturus on his knee, is high up in the east. Below him are the Twins (Gemini).



Start from the zenith, and run your eyes down toward the south-east over the Seven Stars (Pleiades); Aldebaran, in the Hyades; Orion in all his splendor, and Sirius below; and the Milky Way bordering all this array. There is no other part of the sky where one look can cover so much richness. At times—as in March and April—a new moon (not bright enough to dim the stars) or a bright planet in this neighborhood still increases the beauty of this wonderful display. Eleven stars of first magnitude are now visible.

It was at this season, after looking at this part of the sky, that an unknown poet wrote the following lines, which appeared anonymously in a London newspaper nearly forty years ago. In the latitude of England the Great Bear is high up, the “mighty Seven Stars” in the Great Dipper being overhead:

Last night there was a festival in heaven;

The sky burned with a most majestic light.

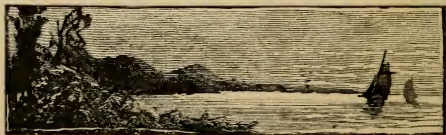
Orion, Lyra, and the mighty Seven

Flamed like the banners of some awful fight.

The stars hung clustering, like white ivy, round  
The oriel window of the curtained sky,  
As though God had with festoons gayly bound  
The cloud-draped arch through which his angels fly.

Perchance the Master, in some distant place,  
Had hung mid-sky a new created world;  
Or with another sun had garnished space,  
Streaming below like a gay flag unfurled:  
Or it might be some great returning day,  
When an archangel by a holy feat  
Gained for his mighty crown another ray  
By mastery at the games where angels meet.

The winds at sunset had an organ's sound,  
And softly played a low religious tune;  
It may be at that hour some saint was crowned  
Who died when thro' his window looked the moon.  
Whatever was the cause, there was in heaven  
A rare and grand display of pomp last night:  
Perhaps the Saviour and the great eleven  
Revealed themselves unto angelic sight.





*FROM NEPTUNE*

*FROM URANUS*

*FROM SATURN*

*FROM JUPITER*

*FROM MERCURY*

*FROM HYGEIA*

*FROM VENUS*

*FROM FLORA*

*FROM THE EARTH*

*FROM MARS*

THE SUN AS SEEN FROM THE PLANETS.

## CHAPTER VI.

### SUN, MOON, AND PLANETS.

\* \* \*

THIS little volume makes no claim to being a text-book in astronomy, for old or young. We therefore do not speak of the distances or sizes of the heavenly bodies. A few items may be given about them, such as may be verified by the young reader from his own observation.

#### THE SUN.

The naked eye can do very little with the sun, though there are a few things about it worth notice. Even a very young person must have noticed that at midday, when the sun is overhead, it is not always in the same spot on our meridian. In winter it is low down toward the south, while in midsummer it is much higher up toward our zenith. Its highest and lowest point depends on the latitude of the observer. In Lower Florida

the sun comes within a very few degrees of the zenith in mid-summer, though it never reaches that point.

Let the young observer notice where the sun sets on any given day. Let the spot on the horizon be marked. In a very few evenings it will be seen to set either farther to the north or south, depending on the season of the year when the observation is made. At the shortest day it sets farthest toward the south, while at the longest it sets farthest toward the north. And so, too, with the rising. Between the farthest northern and southern points of rising (or setting) there is an arc of the horizon whose length depends on the latitude of the observer. In Florida this arc will be about fifty degrees, while in northern Maine it will be about seventy.

The sun, when very near the horizon, rising or setting, sometimes looks unusually large. At other times it seems not round, but oval in shape. Occasionally there are

spots on the sun large enough to be seen by the naked eye.

One very important observation may be made by the learner. Watch the western sky after sunset, and notice the stars that are low down. After a few evenings they will be too near the sun to be seen, and in a few weeks these stars can be seen before sunrise in the east. This shows that there is motion somewhere. The earth must move, or the sun, or the stars.

### THE MOON.

Every month there is a new moon to invite observation. The very word *month* is connected with the word *moon*.

In the case of the sun, all its changes as to place of rising or setting, as well as its change of place when on meridian, are gone through in one year. It is very different with the moon. For several years it has been passing our meridian higher and higher. It will continue to do so for several

years to come (until 1894), when the young people in Florida will see the full moon exactly overhead. This no one of *them* has seen before, as it occurs only once in nearly nineteen years.

The difference between the extreme rising or setting places of the moon on the horizon is greater than in the case of the sun.

Every "new moon" is a new object to look at with admiration. It may be seen when two days old. An instance is related of a keen-eyed young lady who saw the *old* moon one morning before sunrise, and the *new* moon on the following evening after sunset. The points of the crescent in the new moon are always of course turned from the sun. For a few evenings the dark part of the moon can be seen. This is sometimes called the "old moon in the new moon's arms." The bright rim of the moon in such cases looks larger than the dark ball.

The moon passes through the constella-





THE EARTH AS SEEN FROM THE MOON.

tions of the zodiac every month. She moves twelve or thirteen degrees eastward every twenty-four hours. It will be interesting for the young observer to watch the moon night after night, and trace it from one constellation to another. Watch the stars immediately around it one evening, and then see on the next how far eastward it has traveled.

Sometimes the moon passes *over* a bright star or planet, and eclipses it for a short time. This is called *occultation*.

The full moon is opposite to the sun. In winter the sun is low down in the south. The winter full moons are therefore high up. This gives us more moonlight in the long winter nights.

The moon rises later each successive evening by a variable difference of time. With us the difference may be as little as a half-hour, or as much as an hour and a quarter. In higher latitudes the least difference is less than with us. In very high lat-

itudes it may rise about the same hour for several successive evenings. This cannot be the case in any part of our country. With us this difference in the rising of the moon on successive evenings varies from year to year. This is seen especially in the full moons of September and October. For several years to come this difference will be lessening, reaching its limit in 1894. In England, where the difference is less than with us, the September moon is called "harvest moon," and the next is the "hunter's moon."

When a small crescent is seen, the moon shines only through a small part of the night. The half moon shines through half the night. The full moon shines all night.

### PLANETS.

The word *planet* means *wanderer*. The fixed stars keep the same position with regard to each other during the life of any observer. They do not draw nearer each

other, or move apart, in so far as the keenest unaided eye can detect. But a planet is in one neighborhood of stars to-night, and will wander into another neighborhood in a few days or months or years. If Sirius or any other star is on the meridian at 8 o'clock on any given evening, it will be on the meridian at that hour on that evening all your life. But Jupiter or any planet may be on the meridian to-night at 8 o'clock, while one year hence at the same hour it may be far from the meridian. For this reason we could not put down the planets with the stars on successive evenings. We may give some information about them here.

### MERCURY.

This is the nearest planet to the sun that we know of. It moves rapidly, and is always near the sun, which makes it difficult to be seen. Some grown people who have paid considerable attention to astronomy have never seen it. In England and higher

latitudes it is not easily seen, but with us there are several times in each year when it can be seen for several evenings successively. This is the time when it is farthest from the sun. If east of the sun, it can be seen as the evening star; and if west, it rises before the sun, and is seen as morning star. Any almanac will tell when this is the case. The evening is the best time for ordinary observers to hunt for this planet. When the almanac says "Mercury greatest elongation east," at that date (and for a few evenings before and after) look low down in the west, about three-quarters of an hour after sunset. As he is always seen only when near the horizon, Mercury often twinkles like a star, though usually *planets* do not twinkle. It is worth a little trouble to see this brilliant, flashing little planet. It will be easier to find it a second time.

### VENUS.

Venus is morning star for nearly ten

months, and then she is the evening star for the same length of time. The name "morning star" is not strictly correct in the case of a planet, but any thing bright in the sky is popularly called a "star." Venus outshines all the other planets. When brightest, in the absence of the moon, she casts a shadow, and can be seen at midday. She passes through the phases of the moon, but these are not seen with the naked eye, as she is so brilliant that our eyes are dazzled. Through a small telescope, in one part of her circuit, she is seen as a beautiful little crescent. When seen as morning star she is often brighter than as evening star, as the air is quieter and purer. At times Venus passes directly between us and the sun. With the naked eye, looking through a smoked glass, she is seen as a dark spot, taking several hours to go across the bright face of the sun. This took place in December, 1874, when the people of Europe saw this strange sight. In December, 1882, an-

other *transit* took place in *our* day-time, so that all over the United States it was seen by millions. But the youngest reader cannot hope to see a transit of Venus. It cannot occur again until the year 2004. Transits of Mercury are more frequent, but they are less striking and less important to astronomers. One will take place on the evening of May 9, 1891, and another November 10, 1894.

#### MARS.

Mercury and Venus are nearer the sun than our earth. They never get on the other side of the earth from the sun. Neither of these planets is ever seen rising in the east at sunset, nor is either ever seen on the meridian at midnight. When the sun is near the horizon, either rising or setting, Mercury can never be one-third of the way up to the zenith, and Venus never more than half-way up.

Mars is farther from the sun than the earth, and he is seen at all apparent dis-

tances from the sun. Once in two years he is in opposition to the sun—that is, he rises in the east as the sun sets in the west. He is then very bright, and shines with a red, glaring light. For several years the opposition of Mars will take place in the *even* years, 1892, 1894, 1896, etc. These will be the best years in which to see him. The opposition of 1892 will be especially favorable.

### JUPITER.

Jupiter is the kingly planet—not only larger than any other planet, but larger than all other *planets* put together. Being so distant, he is not quite as brilliant as Venus. He is much brighter than any star, being about five times brighter than Sirius, the brightest of all the stars. He travels slowly, taking nearly twelve years to pass through the constellations of the zodiac. He is thus about twelve months in each constellation. During most of the year 1890 he was in Capricornus. He spent most of 1878 in the



same constellation. Since then he has passed through all the other constellations, making one complete circuit. He was brightest (in opposition) July 30, 1890. His oppositions come yearly, each one about five weeks later in the year. For several years this fine planet will be most conspicuous in late summer and fall months. No satellites of Jupiter can be seen by ordinary eyes, but an opera-glass will show them as shining points.

#### SATURN.

Saturn is the most distant planet which the naked eye can see. When in opposition he is quite conspicuous, shining with a "dull, heavy look." He takes thirty years to finish his vast circuit, thus spending more than two years in each constellation. In 1860 he was in the constellation Leo, where he spent all of 1890. When he leaves it, he will not be in it again for thirty years. He was "in opposition" February 18, 1890. His oppositions come about two weeks later

each year. For several years to come he will be seen to greatest advantage in the spring months. When the two great planets Jupiter and Saturn are near together, they form a grand object-lesson. This will not occur for several years.

It is interesting to notice the motions of the planets as they move from one neighborhood of stars to another. In the case of Mars, for example, this motion can be detected in twenty-four hours. In other planets it may take several evenings to make the motions so marked. At times the motion seems to be *backward*. Forward motion means from west to east, taking the constellations in order—Aries, Taurus, Gemini, etc. If a planet passes from Gemini to Taurus, that is backward, as it is backward motion for the hand of a watch to pass from figure III. to figure II. Saturn moves backward among the stars for about four months in every year, Jupiter nearly as long, and Mars for more than two months. This

backward motion is only apparent. It *seems* to us that they go backward, but they are moving forward all the time. The explanation of this singular fact cannot be given here. This and many other interesting and important things in the study of astronomy will come later to the earnest student.

Sir John Herschel has a striking illustration to show the relative sizes and distances of our sun and planets: In a level field place a globe two feet in diameter to represent the sun. Mercury will then be represented by a grain of mustard-seed nearly thirty yards distant; Venus by a pea, forty yards distant; our earth by a pea, seventy yards distant; Mars by a rather large pin's head, one hundred and ten yards distant; Jupiter by a moderate-sized orange, a quarter of a mile distant; Saturn by a small orange, a half-mile distant. On this scale the nearest star will be eight thousand miles distant.

If the eye, when it fixes its gaze upon the vault of heaven, could see in fancy a causeway arched across

the void and bordered on the long series with the hills and plains of an earthly journey, repeated ten thousand and ten thousand times, until ages were spent in the pilgrimage; then would he who possessed such power of vision hide himself in caverns rather than venture to look up to the terrible magnitude of the starry skies thus set out in parts before him.—*Isaac Taylor.*

Of old hast thou laid the foundation of the earth;  
And the heavens are the work of thy hands.  
They shall perish, but thou shalt endure:  
Yea, all of them shall wax old, like a garment;  
As a vesture shalt thou change them, and they shall be  
changed:

But thou art the same,  
And thy years shall have no end.

—*Psalms cii. 25-27.*



# INDEX.

\* \* \*

	PAGE
Andromeda.....	114
Aquarius (Waterman).....	101
Aquila (Eagle).....	69
Argo Navis (Southern Ship).....	45
Aries (Ram).....	116
Auriga (Charioteer).....	41
Bootes— <i>Bo-ô-tes</i> .....	65
Camelopard.....	23
Canis Berenice (Berenice's Hair).....	55
Cancer (Crab).....	51
Canis Major (Larger Dog).....	44
Canis Minor (Smaller Dog).....	49
Capricornus .....	100
Cassiopeia.....	22
Centaurus.....	67
Cepheus.....	23
Cetus (Whale).....	107
Corona Borealis (Northern Crown).....	78
Corvus (Crow).....	67
Cygnus (Swan) .....	95
Delphinus (Dolphin) .....	98
Draco.....	84
Eridanus (River Po).....	109

	PAGE
Gemini (Twins).....	47
Hercules .....	82
Hydra (Water Snake).....	56
Leo Major (Larger Lion).....	53
Leo Minor (Smaller Lion).....	53
Libra (Scales).....	72
Lynx.....	48
Lyra (Harp) .....	86
Monoceros (Unicorn).....	50
Orion.....	37
Pegasus (Winged Horse).....	105
Perseus.....	35
Pisces Australis (Southern Fish).....	103
Pisces (Fishes).....	118
Sagittarius (Archer).....	93
Scorpio (Scorpion).....	80
Serpentarius (Serpent) .....	83
Taurus (Bull).....	34
Ursa Major (Larger Bear).....	12
Ursa Minor (Smaller Bear).....	14
Virgo (Virgin).....	58
Zodiac .....	90







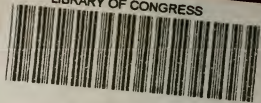








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